PART II

SUPPLEMENTS TO SERIES M AND N RECOMMENDATIONS

Blanc

MONTAGE: PAGE 94 = PAGE BLANCHE

1 Technical information

Supplement No. 1.1

PREFIXES USED IN THE DECIMAL SYSTEM

(For this Supplement, see page 409, Volume IV.2 of the *Green Book*)

Supplement No. 1.2

TRANSMISSION MEASUREMENT CONVERSION TABLES

(For this Supplement, see page 409, Volume IV.2 of the *Green Book)*

Supplement No. 1.3

THE NORMAL (OR LAPLACE-GAUSS) DISTRIBUTION

(For this Supplement, see page 416, Volume IV.2 of the *Green Book*)

Supplement No. 1.4

METHODS OF QUALITY CONTROL

(For this Supplement, see page 422, Volume IV.2 of the *Green Book*)

Supplement No. 1.5

MATHEMATICAL PROCESSING OF THE MEASUREMENT RESULTS

OF THE VARIATIONS OF THE OVERALL LOSS OF TELEPHONE CIRCUITS

(For this Supplement, see page 451, Volume IV.2
of the *Green Book*)

Supplement No. 1.6

STATISTICAL THEORY REQUIREMENTS

(For this Supplement, see page 459, Volume IV.2 of the *Green Book*)

2 Measuring techniques

Supplement No. 2.1

SOME GENERAL OBSERVATIONS CONCERNING MEASURING INSTRUMENTS

AND MEASURING TECHNIQUES

(For this Supplement, see page 463, Volume IV.2 of the *Green Book*)

Supplement No. 2.2

MEASUREMENTS OF LOSS

(For this Supplement, see page 471, Volume IV.2 of the *Green Book*)

Supplement No. 2.3

LEVEL MEASUREMENTS

(For this Supplement, see page 475, Volume IV.2 of the *Green Book*)

Supplement No. 2.4

MEASUREMENT OF CROSSTALK

(For this Supplement, see page 480, Volume IV.2 of the *Green Book*)

Supplement No. 2.5

MEASURING ERRORS AND DIFFERENCES DUE TO IMPEDANCE INACCURACIES

OF INSTRUMENTS AND APPARATUS. USE OF DECOUPLED MEASURING POINTS

(For this Supplement, see page 482, Volume IV.2 of the *Green Book*)

Supplement No. 2.6

ERRORS IN THE INDICATIONS GIVEN BY LEVEL-MEASURING INSTRUMENTS DUE TO INTERFERING SIGNALS

(For this Supplement, see page 489, Volume IV.2 of the *Green Book*)

Supplement No. 2.7

MEASUREMENT OF GROUP DELAY AND GROUP-DELAY DISTORTION

(For this Supplement, see page 492, Volume IV.2 of the *Green Book*)

Supplement No. 2.8

MEASUREMENTS OF SUDDEN PHASE CHANGES ON CIRCUITS

(For this Supplement, see page 508, Volume IV.2 of the *Green Book*)

Supplement No. 2.9

VIBRATION TESTING

(For this Supplement, see page 511, Volume IV.2 of the *Green Book*)

Supplement No. 2.10

METHOD FOR MEASURING THE FREQUENCY SHIFT INTRODUCED BY A CARRIER CHANNEL

(For this Supplement, see page 522, Volume IV.2 of the *Green Book*)

Supplement No. 2.11

RAPID VERIFICATION TEST FOR ECHO CONTROL DEVICES

Recommendation M.580 discusses the setting-up and lining-up of international circuits for public telephony. This Supplement describes a method for the rapid verification of adequate echo control on those circuits fitted with echo control devices when they are initially established.

1 This test should be performed after all loss and noise testing of a newly established circuit is completed. It consists of an exchange of tones to verify that the echo control device at each terminal is functional as wired in the circuit.

2 The circuit control should initiate the test with the distant international maintenance centre. It is intended to be applied during initial line-up to every circuit (manual and automatic) with a control device at each terminal should there be any doubt that echo control is not effective for either end.

3 If we label the calling maintenance centre the A Terminal, and the called maintenance centre the B Terminal, the following sequential procedure should be applied as indicated, and then also with A and B interchanged.

3.1 Terminal A sends a 1020 Hz tone at —15 dBm0 to Terminal B.

3.2 Terminal B sends a 1020 Hz tone at —21 dBm0 to Terminal A after the 1020 Hz tone is heard at B.

3.3 No 1020 Hz tone should be heard at Terminal A. *On the contrary* , if a tone is heard, echo control at Terminal B is not taking place. The echo control device at B should be checked as appropriate to the type of device in the circuit.

For additional information concerning the choice of a test frequency, see Recommendation O.6 [1]

3.4 Remove the 1020 Hz tone at Terminal A to cause the release of the echo control device at Terminal B.

3.5 The 1020 Hz tone from Terminal B should be heard at Terminal A to verify that the B control device has released. *On the contrary* , if tone is not heard, check the echo control device B.

3.6 Remove all 1020 Hz test tones from Terminal A and Terminal B. The above test is simply a check to determine that the echo control device is effectively in the circuit at each terminal. *It is not a substitute for detailed echo control device testing* .

Reference

[1] CCITT Recommendation *1020 Hz reference test frequency* , Vol. IV, Rec. O.6.

Supplement No. 2.12

AN AUTOMATIC DATA ACQUISITION AND EFFECTIVE PROCESSING PROCEDURE FOR GROUP AND SUPERGROUP PILOT LEVELS

(For this Supplement, see page 524, Volume IV.2 of the *Green Book*)

Supplement No. 2.13

LOOP METHOD FOR THE MAINTENANCE OF 4-WIRE TELEPHONE-TYPE LEASED CIRCUITS

(For this Supplement, see page 267, Volume IV.1 of the *Orange Book*)

Supplement No. 2.14

AUTOMATIC MEASURING DEVICE FOR CARRIER SYSTEMS WITH A LARGE NUMBER OF CHANNELS

(For this Supplement, see page 268, Volume IV.1 of the *Orange Book*)

Supplement No. 2.15

DETECTION OF CIRCUIT FAULTS

(For this Supplement, see page 275, Volume IV.1
of the *Orange Book*)

Supplement No. 2.16

RECEIVING RELATIVE LEVELS AT RENTERS' PREMISES FOR INTERNATIONAL LEASED CIRCUITS USED FOR DATA TRANSMISSION

1 General

In the Series M Recommendations dealing with special quality international leased circuits (Recommendations M.1020 [1] and M.1025 [2]), it is advised that the receiving relative level at the renters' premises should not be lower than —13 dBr. This is a minimum value, and assumes that the power of the transmitted data signal is the maximum allowed by Recommendation V.2 [3], namely —13 dBm0.

This Supplement is based upon the replies received to the questionnaire appearing in CCITT Collective letter No. 17 (11 June 1981). A detailed analysis of the replies appears in Contribution COM IV-No. 46 of the 1981-1984 Study Period.

Under the above conditions, the absolute power available to the line signal detector of the receiving data modem is —26 dBm — the minimum value required by some modems specified in Series V Recommendations.

The value of —13 dBr makes no allowance for present and foreseen influences on the received absolute power at data modems, as discussed below.

2 Influences on the absolute power received at renters' premises

2.1 *General*

The value of absolute power received at a renter's premises (and therefore available to a modem) is influenced by a number of factors, as follows:

- power of the data signal transmitted by the sending modem;
- variations of overall loss with time on the international leased circuit;
- effect of loss/frequency distortion on the international leased circuit;
- errors in circuit engineering and line-up.

Each of these influences is discussed below.

2.2 *Transmitted power*

The majority of Administrations have adopted the maximum data signal power level permitted by Recommendation V.2 [3], namely, —13 dBm0. However, a significant number of Administrations already use a level of —15 dBm0, while others intend to use this level in the future.

2.3 *Variations of overall loss with time*

The overall loss of an international leased circuit is permitted to vary between ± | dB of the nominal value; see, for example, Recommendation M.1020 [1], § 2.4.

In the international network and many national networks, extensive use is made of automatic gain control equipment on FDM groups, supergroups, etc. and on transmission systems. Also, improved circuit engineering and an expanding international network have led to circuits having relatively simple constitutions. Finally, international leased circuits benefit from the inherent gain stability of digital transmission media, which are increasingly being used in their provision.

The net effect of the above factors is that the expected variation in overall loss of an international leased circuit is much lower than ± | dB, and may be negligible in most cases.

2.4 *Loss/frequency distortion*

The loss/frequency distortion of an international leased circuit is determined with respect to the loss at 1020 Hz. However, the centre of the frequency band produced by Series V data modems is in the range 1700 Hz to 1800 Hz.

Where a circuit has required equalization for loss/frequency distortion, the difference between the loss at 1020 Hz and that at 1700/1800 Hz is negligibly small. But, where a circuit does not have required equalization, this difference can be significant. Typical values are 1 dB for circuits to Recommendation M.1020 [1], and 5 dB for circuits to Recommendation M.1025 [2].

2.5 *Errors in circuit engineering or line-up*

Any error in the engineering or line-up of an international leased circuit which increases/decreases its nominal overall loss will obviously have a direct and proportional impact on the absolute power received at the renter’s premises.

3 Impact on the receiving relative level at renters’ premises

Each of the factors discussed in § 2 will have a calculable impact upon the absolute power received at a renter’s premises. This impact is likely to differ for different Administrations and will depend upon such influences as the size of the national network, the extent to which automatic gain control is used and the relations with which the Administration operates circuits.

Thus, individual Administrations must determine what impact, if any, the factors in § 2 have upon the receiving relative level they must adopt (have adopted) to ensure proper modem operation.

References

[1] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning* , Vol. IV, Rec. M.1020.

[2] CCITT Recommendation *Characteristics of special quality international leased circuits with basic bandwidth conditioning* , Vol. IV, Rec. M.1025.

[3] CCITT Recommendation *Power levels for data transmission over telephone lines* , Vol. VIII, Rec. V.2.

Supplement No. 2.17

RESULTS OF AN INVESTIGATION OF THE SERVICE AVAILABILITY PERFORMANCE OF INTERNATIONAL LEASED CIRCUITS MADE IN 1982

1 Introduction

Using the assessment procedure specified in Recommendation M.1016 [1], 13 Administrations participated in an investigation of the service availability performance of their mutual international leased circuits. This investigation was undertaken from 1 January 1982 (0000 UTC) to 31 March 1982 (2400 UTC), and involved 910 full-time, point-to-point international leased circuits.

This supplement contains the results of this investigation, as evaluated by the Federal Republic of Germany.

2 Results

2.1 Table 1 gives the general performance results for all (910) international leased circuits involved. The results under column B are based on faults and down-times known to the control stations (Recommendation M.1012 [2]) of the circuits. The results under column C are based on information from the sub-control stations (Recommendation M.1013 [3]) *and* the control stations.

2.2 Table 2 gives the service availability performance results for each Administration involved in the investigation. For each case, only those international leased circuits to the remaining 12 Administrations participating in the investigation are included.

2.3 The cumulative frequency distribution graph in Figure 1 shows the percentage of circuits (*y* -axis) and the corresponding downtime (*x* -axis) recorded during the observation period. The key results (from Table 1, column B) have been shown on the graph.

2.4 In accordance with the procedures specified in Recommendation M.1016 [1] (§ 5.2 and Annex C), the Administrations participating in the performance assessment also exchanged additional information for consideration when results from different sources are compared.

UTC = Coordinated universal time (UTC equals GMT, but replaces it).

The results of the analysis of this information appear in Table 3. Again, column B relates to information from the control stations while column C is based on information from both control and sub-control stations.

2.5 It must be emphasized that all the results in Tables 1 and 2 and Figure 1 relate to a three-month observation period, as mentioned in § 1 above.

H.T. [T1.217]

TABLE 1

Data and service availability performance results for all circuits involved in the assessment

(Observation period = 3 months)

Information from: Data and results (A) Control and sub-control stations (C) }	Control station (B)	{

{
910
| 10
b)
Number of faults on all circuits
}
{
1357
2 | 49
c)
Downtime of all circuits
(h)
8819
11 | 50
d)
Mean downtime per circuit
(h)
9.7
| 2.8
e)
Mean time to restore service (MTRS)
(h)
6.5
| .7
f)
Mean number of faults per circuit
}
1.49
| .25
g)
Mean availability per circuit
(%)
99.55
| 9.40
h)
Mean time to failure (MTTF)
(h)
1443
| 54
i)
Circuits with downtime better than mean value
(%)
80.0
j)
Circuits for which no downtime was recorded
(%)
47.7
k)
Downtime not exceeded by 95% of the circuits

(h) 54.0			

Note — A later investigation held in 1983 on 22 circuits showed results which are in line with the above results.

Table 1 [T1.217], p. 1

H.T. [T2.217]

TABLE 2

Results from each country to all other countries

Investigation of international leased circuits

(Observation period = 3 months)

{ (a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) }		(hours) (hours) (hours)	(%) (hours) (%) (%) (hours)								

Table 2 [T2.217], p. 2

Figure 1, p. 3

H.T. [T3.217]

TABLE 3

Results of analysis of additional information exchanged between the participating Administrations

Replies (% of circuits)	Control station only (B) {	

Table 3 [T3.217], p. 4

References

[1] CCITT Recommendation *Assessment of the service availability performance of international leased circuits* , Vol. IV. Rec. 1016.

[2] CCITT Recommendation *Circuit control station for leased and special circuits* , Vol. IV, Rec. M.1012.

[3] CCITT Recommendation *Sub-control station for leased and special circuits* , Vol. IV, Rec. M.1013.

[4] CCITT Recommendation *Characteristics of ordinary quality international leased circuits* , Vol. IV, Rec. M.1040.

[5] CCITT Recommendation *Characteristics of special quality international leased circuits with special bandwidth conditioning* , Vol. IV, Rec. M.1020.

[6] CCITT Recommendation *Characteristics of special quality international leased circuits with basic bandwidth conditioning* , Vol. IV, Rec. M.1025.

3 Supplements to the Series O Recommendations

(see Fascicle IV.4)

4 Transmission performance of the international network

Supplement No. 4.1

STABILITY OF OVERALL LOSS AND PSOPHOMETRIC NOISE: RESULTS OF ROUTINE MAINTENANCE MEASUREMENTS MADE ON THE INTERNATIONAL NETWORK

DURING THE FIRST HALF OF 1978

(For this Supplement, see page 68 of Fascicle IV.3 of the *Yellow Book*)

Supplement No. 4.2

RESULTS AND ANALYSIS OF THE 10th SERIES OF TESTS

OF SHORT BREAKS IN TRANSMISSION

(For this Supplement, see page 80 of Fascicle IV.3 of the *Yellow Book*)

Supplement No. 4.3

CHARACTERISTICS OF LEASED INTERNATIONAL TELEPHONE-TYPE CIRCUITS

(For this Supplement, see page 564, Volume IV.2 of the *Green Book*)

Supplement No. 4.5

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF COMPLETE CONNECTIONS FOR RECORDING

THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 569, Volume IV.2 of the *Green Book*)

Supplement No. 4.6

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF NATIONAL EXTENSIONS (EXCLUDING SUBSCRIBER'S LOCAL LINES)

AND FOR RECORDING THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 580, Volume IV.2 of the *Green Book*)

Supplement No. 4.7

INSTRUCTIONS FOR MAKING FUTURE MEASUREMENTS OF THE TRANSMISSION QUALITY OF INTERNATIONAL CIRCUITS AND INTERNATIONAL CENTRES AND

FOR RECORDING THE RESULTS OF THE MEASUREMENTS

(For this Supplement, see page 587, Volume IV.2 of the *Green Book*)

Supplement No. 4.8

RESULTS AND ANALYSIS OF TESTS OF IMPULSIVE NOISE

(For this Supplement, see page 593, Volume IV.2 of the *Green Book*)

Supplement No. 4.9

WEIGHTING OF MEASUREMENTS RELATING TO THE STABILITY OF CIRCUITS IN THE INTERNATIONAL NETWORK ACCORDING TO THE SIZE

OF CIRCUIT GROUPS

(For this Supplement, see page 283, Volume IV.1
of the *Orange Book*)

Supplement No. 4.10

TRANSIENT ANALOGUE CIRCUIT IMPAIRMENTS

AND THEIR EFFECT ON DATA TRANSMISSION

(For this Supplement, see page 86 of Fascicle IV.3 of the *Yellow Book*)

5 Maintenance of television circuits

Supplement No. 5.1

REQUIREMENTS FOR THE TRANSMISSION OF TELEVISION

SIGNALS OVER LONG DISTANCES

(For this Supplement, see page 598 of Fascicle IV.2 of the *Green Book*)

Supplement No. 5.2

SETTING-UP AND TESTING OF INTERNATIONAL

VIDEOCONFERENCE STUDIOS

(Information submitted by the United Kingdom)

1 To ensure the adequate performance of international digital videoconference calls it is necessary to check, before any video-conference studio is put into international service, compatibility with existing studios and that minimum technical standards are achieved.

The standards for establishing a videoconference studio are given in [1].

Having established a new videoconference studio to these standards it is then necessary to make checks of the satisfactory performance between the new studio and an established (reference) studio. These checks are described in the following sections.

2 Test equipment

To conduct the tests it will be necessary to have the following test equipment:

a) a white noise generator set to a bandwidth of 50 Hz-10 kHz;

b) a filter which produces a flat (within 3 dB) white or pink noise response within the band 250-3000 Hz rolling off at 48 dB/octave outside these limits;

c) an audio amplifier and associated loudspeaker with the following properties:

i) the loudspeaker must be able to deliver a sound pressure level of at least 100 dB SPL at 150 mm from the loudspeaker in the axis of the loudspeaker;

ii) the acoustic properties must be similar to the average human mouth (as regards the law of decreasing acoustic pressure in the axis of emission and the law of directivity);

iii) the loudspeaker must be single and small (diameter less than 15 cm) conforming to DIN 45 | 00;

d) a sound pressure level meter (with A-weighting and linear scale);

e) a level measuring set.

3 Video tests

3.1 Electronically generated colour bars should be viewed on video monitors both locally, and at the distant end, from each camera in turn and any noticeable degradation should be corrected.

3.2 Each camera should be checked in turn for correct colour balance and saturation. Cameras with remote pan, zoom or focus options should also have those tested.

3.3 Satisfactory pictures of the distant studio should be subjectively judged on the local studio monitor.

3.4 Camera switching should also be tested. Switching should not cause excessive break-up of picture. Composite syncs should be in synchronisation and colour subcarriers should be in phase for all video sources.

3.5 Facilities such as graphics, split screen, slides, facsimile, etc, should be tested to ensure correct operation. (When testing the graphics option, it is important to ensure that the codec has been switched to its high resolution mode.)

4 Audio tests

The audio tests described in § 4.2 shall be performed after the studio has been set up in accordance with § 4.1.

The audio levels should be set up using a white noise source. The position of microphones should not be changed throughout the tests and should represent their location during actual calls.

It should be noted that the levels specified for the following tests are based on those given in [1] but modified by experience.

SPL = sound pressure level

4.1 *Local audio test*

i) Connect the white noise generator, filter, amplifier and loudspeaker in series. With the Sound Pressure Level Meter (SPLM) placed as in Figure 1, a), adjust the white noise level to measure 90 dBSPL on the SPLM.

ii) The loudspeaker should now be positioned relative to the optical reference point (ORP — see Note) as in Figure 1b) and the audio levels at the input to the codec should have an average value of —9 dBm with respect to all seating positions. Any adjustment to achieve this should be made immediately prior to the codec (Figure 1, b)).

Note — The optical reference point is the point located 1200 mm from the floor level and 150 mm to the rear of the working edge of the conference desk and on the centre line of each seating position.

iii) The white noise generator, filter and amplifier should be used to simulate the nominal received level (—9 dBm) from a codec into the studio loudspeaker. Measure the sound pressure level at the ORP which should be in the range of 67 to 75 dBA, depending on the acoustic conditions (Figure 1, c)).

The audio level at the input to the codec due to loudspeaker/microphone acoustic coupling should be measured at less than —40 dBm.

Figure 1, p. 5

4.2 *Audio tests (studio-to-studio)* | Figure 2)

In the following tests, each end will be required to send and measure audio levels at the codec interface. For ease of testing each end has been designated either A or B and this should be decided prior to any testing.

The received level at ‘‘A’’ will be referred to as studio Level 1 and the received level at ‘‘B’’ will be referred to as studio Level 2.

Figure 2, p. 6

The white noise source referred to below is positioned as in Figure 1, b) and adjusted as described in § 4.1 ii).

— *Electrical noise*

Conditions: A and B mute room microphones.

A and B enable echo canceller.

Measurements: Level 1 = electrical noise from Studio B.

Level 2 = electrical noise from Studio A.

Specification: Level 2 < —53 dBm (flat) at audio output of codec.

Level 1 < —53 dBm (flat) at audio output of codec.

4.2.1 *‘‘A’’ end audio tests*

a) *Level check*

Conditions: B sends white noise source at —9 dBm level.

B enables studio microphone.

A mutes studio microphone.

A and B enable echo cancellers.

Measurements: i) A measures Level 1 at audio output of codec.

ii) A measures sound pressure level at ORP.

Specification: i) Level 1 at audio output of codec = —9 dBm.

ii) Level at ORP = 67 to 75 dBA.

b) *Echo check*

Conditions: A sends white noise at —9 dBm level.

B enables studio microphones.

A and B enable echo cancellers.

Measurements: A measures Level 1 (echo).

Specification: Level 1 < —40 dBm at audio output of codec.

c) *Echo return loss measurement*

Conditions: A sends white noise at —9 dBm level.

B enables studio microphones.

A enables echo canceller.

B disables echo canceller.

Measurements: A measures Level 1.

Specification: Level 1 < —15 dBm at audio output of codec.

d) *Crosstalk check*

Conditions: A sends white noise at —9 dBm level.

B mutes studio microphones.

A and B enable echo canceller.

Measurements: A measures level 1 (crosstalk).

Specification: Level 1 < —50 dBm.

4.2.2 *‘‘B’’ end audio tests*

a) *Level check*

Conditions: A sends white noise source at —9 dBm level.

A enables source microphone.

B mutes studio microphone.

B and A enable echo cancellers.

Measurements: i) B measures Level 1 at audio output of codec.

ii) B measures sound pressure level at ORP.

Specification: i) Level 2 at audio output of codec = —9 dBm.

ii) Level at ORP = 67 to 75 dBA.

b) *Echo check*

Conditions: B sends white noise a —9 dBm level.

A enables studio microphones.

B and A enable echo cancellers.

Measurements: B measures Level 1 (echo).

Specification: Level 2 < —40 dBm at audio output of codec.

c) *Echo return loss measurement*

Conditions: B sends white noise at —9 dBm level.

A enables studio microphones.

B enables echo canceller.

A disables echo canceller.

Measurements: B measures Level 2.

Specification: Level 2 < —15 dBm at audio output of codec.

d) Crosstalk check

Conditions: B sends white noise at —9 dBm level.

A mutes studio microphones.

B and A enable echo canceller.

Measurements: B measures Level 2 (crosstalk).

Specification: Level 2 < —50 dBm.

5 Overall subjective checks

As a final confidence check, the general quality of the sound and vision received from the distant studio should be subjectively checked at the ‘‘A’’ and ‘‘B’’ ends for all seating positions.

Reference

[1] CEPT T/TR 01-02E (Nice, 1985)

6 Miscellaneous

Supplement No. 6.1

EFFECT ON MAINTENANCE OF THE INTRODUCTION OF NEW COMPONENTS AND OF MODERN EQUIPMENT DESIGN

(For this Supplement, see page 620, Volume IV.2 of the *Green Book*)

Supplement No. 6.2

NEW OPERATION AND MAINTENANCE ORGANIZATION IN THE MILAN ITALCABLE INTERCONTINENTAL TELECOMMUNICATIONS CENTRE

(Information submitted by Italcable)

1 Introduction

The purpose of this Supplement is to inform the readers of Volume IV about the new operation and maintenance organization which began service in 1986 in the Milan Italcable Intercontinental Telecommunications Centre.

The organization which has been implemented consists essentially in the integration of the transmission, line signalling and switching technical staff into one single group.

The motivation behind these changes is that at the Italcable Centre the type of switching equipment is completely electronic, equipment rooms of the Centre are grouped in a logistical arrangement and the digitalization process within the Centre is at an advanced stage.

This situation has given Italcable the opportunity to change its organization to exploit the advantages offered by a purely digital network.

2 Logistical arrangement of equipment rooms

— The transmission and switching systems are on the same floor.

— The supervision room is the same for the transmission and switching equipment and is placed in an intermediate position between the rooms where the transmission and switching systems are located.

— The supervision of both transmission and switching systems from the same technical staff allows integrated control of the the telephone system and faster elimination of failures.

3 Digitalization process

In Italy, as in other countries, the process of digitalization of the transmission and switching equipment is in the phase of gradual implementation.

Particularly in the Milan Italcable Intercontinental Centre a digital switching system is in the phase of testing (at present 2 SPC wholly electronic exchanges of the type TDM/PAM are active).

The switching exchanges in Italy with which the Milan Italcable Centre is connected are also replacing their electromechanical switches with digital ones.

4 Technicians training

The most onerous problem that Italcable had to overcome was re-training the technical staff by means of courses and the organization of periods of cooperative work in order to obtain a homogeneous and thorough preparation of technicians with different knowledge and background experience.

To guarantee the operation and the maintenance of the transmission and switching equipment, Italcable had to provide the same course twice for two separate groups, in order that a group of qualified technicians was always available for service.

This principle was attained both for the switching technicians who attended a transmission course and for the transmission technicians who attended a switching course.

A period of side-by-side collaboration followed the theoretical training in order to obtain the experience required.

The whole training phase lasted about 10 months for a total of 35 man-months.

5 Organization

Italcable has now an organization for the transmission and the switching equipment which is subdivided into 4 sections, namely:

1) planning,

2) operation,

3) hardware maintenance,

4) software maintenance.

Only the staff of the Operation Section, which is employed for maintaining the continuity of service, is present 24 hours a day, seven days a week.

The other technicians work normal office hours five days a week. This has allowed in the Milan Centre an easy transition towards an organization, which has now been carried out, based on a division according to functions.

6 Conclusions

After about a year of experience with the new organization, it is possible to estimate with some certainty the advantages reached in the Milan Intercontinental Centre to which about 3000 circuits are connected (about 1200 are international):

1) The centralized supervision of the transmission and switching equipment has eliminated the wasted periods of time which were needed for the transmission of failure information between transmission and switching staff. It has also allowed a global view of the telephone communication process and, consequently, it has reduced the duration of ‘‘out-of-service periods’’.

2) The integration of the switching and transmission functions has improved the efficiency of the staff and it has increased the operational efficiency (+16% improvement in number of operated circuits/man-hours worked monthly).

3) As a whole there has been an improvement, both in quality of service and availability of the transmission and switching systems.

4) Concerning the changes involved for the operation staff, it is evident that this has become less problematic and overall more efficient.

Blanc