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THE INTERNATIONAL
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CONSULTATIVE COMMITTEE

M.1025

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SERIES M: MAINTENANCE OF INTERNATIONAL TELEGRAPH, PHOTOTELEGRAPH AND LEASED CIRCUITS

MAINTENANCE OF THE INTERNATIONAL PUBLIC TELEPHONE NETWORK

MAINTENANCE OF MARITIME SATELLITE AND DATA TRANSMISSION SYSTEMS

International leased circuits

CHARACTERISTICS OF SPECIAL QUALITY INTERNATIONAL LEASED CIRCUITS WITH BASIC BANDWIDTH CONDITIONING

Reedition of CCITT Recommendation M.1025 published in the Blue Book, Fascicle IV.2 (1988)

NOTES

1 CCITT Recommendation M.1025 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.1025

CHARACTERISTICS OF SPECIAL QUALITY INTERNATIONAL LEASED CIRCUITS WITH BASIC BANDWIDTH CONDITIONING[1)]

1 Scope

This Recommendation deals with leased circuits for uses other than telephony – for example, data transmission.

The requirements of this Recommendation are intended to ensure the provision of a circuit which will meet the requirements of digital transmission rates higher than those possible on a normal telephone-type circuit.[2)] In particular, circuits meeting the requirements of this Recommendation are intended for use with modems which contain equalizers. Circuits conforming to Recommendation M.1025 may not always support satisfactory operation of modems to Recommendation V.29 [1]. This is dependent upon the equalization capability of the particular modems used.

2 Characteristics[3)]

2.1 *Nominal overall loss*

Because of the differing nominal level at renters' premises due to the various national practices, it is not normally possible to predict the nominal overall loss of the circuit at the reference frequency. Only exceptionally can a predetermined specified nominal overall loss at the reference frequency between renters' installations be offered to renters and then only after prior consultation among the Administrations concerned.

For 4-wire circuits the value of the receiving relative level at the renters' premises should not be lower than −13 dBr.

For circuits intended to be used for data transmission using modems to Series V Recommendations, higher receiving relative levels may be required in some circumstances. Reference should be made to Supplement No. 2.16 to Volume IV (Fascicle IV.3).

It should be noted that the overall loss in each direction of transmission may not have the same value.

2.2 *Loss/frequency distortion*[4), 5)]

The limits for the overall loss relative to that at 1020 Hz for the circuit between renters' installations are given in Figure 1/M.1025.

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1) The application of this Recommendation to multiterminal leased circuits is intended only for radial networks in which these specifications are to be met between a designated central station and each of the outlying stations. It does not apply to multiterminal conference networks between any two stations.

2) In order to ensure the proper operation of certain Series V modems operating at data signalling rates greater than 4800 bit/s, it is necessary to specify improved and/or modified values for the following transmission system characteristics: random circuit noise, quantizing noise, harmonic distortion (intermodulation distortion). This subject is for further study.

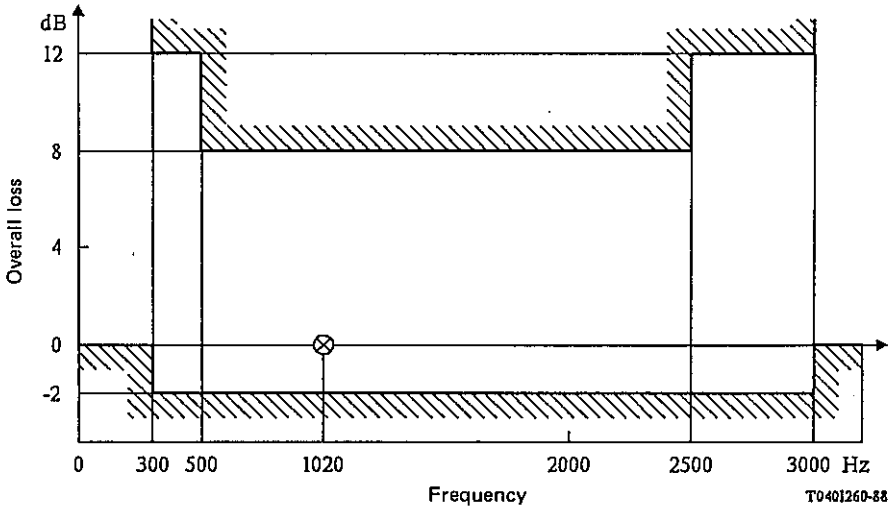
3) Additionally, the characteristics and limits for short interruptions in transmission and phase hits are under study for inclusion in this Recommendation. It may be noted that § 6 of Recommendation M.1060 gives provisional limits for short interruptions in transmission and phase hits as guidance for fault finding purposes.

4) It is expected that, in most cases, these "basic bandwidth" characteristics may be available without the addition of loss/frequency and/or group-delay equalization equipment.

5) The values of loss/frequency and group-delay distortion are provisional and should be confirmed or amended after further study.

2.3 *Group-delay distortion* [6),7)]

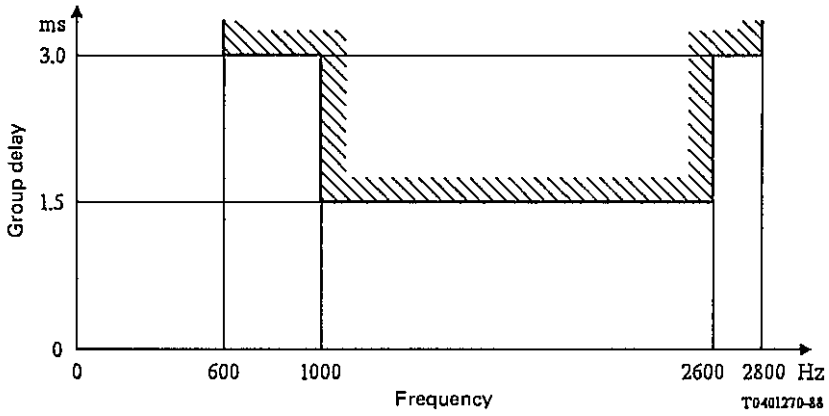
The limits that apply to group-delay distortion are given in Figure 2/M.1025 in which the limiting values over the frequency band are expressed as values relative to the minimum measured group delay.



Note – Below 300 Hz and above 3000 Hz the loss shall not be less than 0.0 dB, but is otherwise unspecified. These frequencies should be confirmed or amended after further study.

FIGURE 1/M.1025

Limits for overall loss of the circuit relative to that at 1020 Hz



Note – It should be noted that the value of 3.0 ms between 600 and 1000 Hz should be confirmed or amended after further study, to ensure that equalization would not be necessary in the majority of cases and that proper modem operation is achieved.

FIGURE 2/M.1025

Limits for group delay relative to the minimum measured group delay in the 600-2800 Hz band

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6) It is expected that, in most cases, these "basic bandwidth" characteristics may be available without the addition of loss/frequency and/or group-delay equalization equipment.

7) The values of loss/frequency and group-delay distortion are provisional and should be confirmed or amended after further study.

2.4 *Variation of overall loss with time*

2.4.1 *Amplitude hits*

Where the circuit is to be used for data transmission using modems employing amplitude modulation techniques, for example modems to Recommendation V.29 [1], amplitude hits may result in data errors. Using an instrument complying with Recommendation O.95 [2], the number of amplitude hits greater than ±2 dB should not exceed 10 in any 15 minute measuring period. The value of ±2 dB and the number of amplitude hits are provisional and subject to further study.

2.4.2 *Other variations*

For all circuits, variations with time of the overall loss at 1020 Hz (including daily and seasonal variations but excluding amplitude hits) should be as small as possible but should not exceed ±4 dB.

2.5 *Random circuit noise*

The level of the psophometric noise power at a renter's premises depends upon the actual constitution of the circuit, in particular upon the length of circuit of frequency division multiplex carrier systems. The provisional limit for leased circuits of distances greater than 10 000 kilometres is –38 dBm0p. However, circuits of shorter length will have substantially less random noise (see also Annex A to this Recommendation and Recommendation M.1050, § 3.5).

2.6 *Impulsive noise*

Impulsive noise should be measured with an instrument complying with Recommendation O.71 [3]. As a provisional limit, the number of impulsive noise peaks exceeding –21 dBm0 should not be more than 18 in 15 minutes.

2.7 *Phase jitter*

The value of phase jitter measured at a renter's premises depends upon the actual constitution of the circuit (for example, upon the number of modulation equipments involved). It is expected that any measurement of phase jitter using an instrument complying with Recommendation O.91 [4] will not normally exceed 10° peak-to-peak. However, for circuits of necessarily complex constitution and where 10° peak-to-peak cannot be met, a limit of up to 15° peak-to-peak is permitted. The limits for low frequency phase jitter are under study.

2.8 *Total distortion (including quantizing distortion)*

On a mixed analogue/digital circuit, the signal will be accompanied by quantizing distortion. An end-to-end distortion measurement made using an instrument conforming to Recommendation O.132 [5] will include contributions from random circuit noise, single tone interference and harmonic distortion. The level of random noise power at the renter's premises depends upon the length of circuit of frequency division multiplex carrier systems. The level of quantizing distortion power depends on the number of unintegrated digital processes in the circuit.

The signal-to-total-distortion ratio should be better than 28 dB using a sine wave signal at –10 dBm0 (see also Annex A).

2.9 *Single tone interference*

The level of single tone interference in the band 300-3 400 Hz shall not exceed a value which is 3 dB below the circuit noise objective indicated in Figure A-1/M.1025.

2.10 *Frequency error*

The frequency error introduced by the circuit must not exceed ±5 Hz. It is expected that in practice the error will be within closer limits than these.

2.11 *Harmonic and intermodulation distortion*

When a 700-Hz test frequency of –13 dBm0 is injected at the transmit end of a point-to-point circuit, the level of any individual harmonic frequency at the receiving end shall provisionally be at least 25 dB below the received level of the fundamental frequency.

The limit of second and third order intermodulation products measured using an instrument complying with Recommendation O.42 [6] is for further study.

ANNEX A

(to Recommendation M.1025)

Noise and distortion

A.1 *Random circuit noise*

Figure A-1/M.1025 displays random noise versus length of circuit of FDM carrier systems and is presented as a guide to the random noise performance which may be found on an international leased circuit.

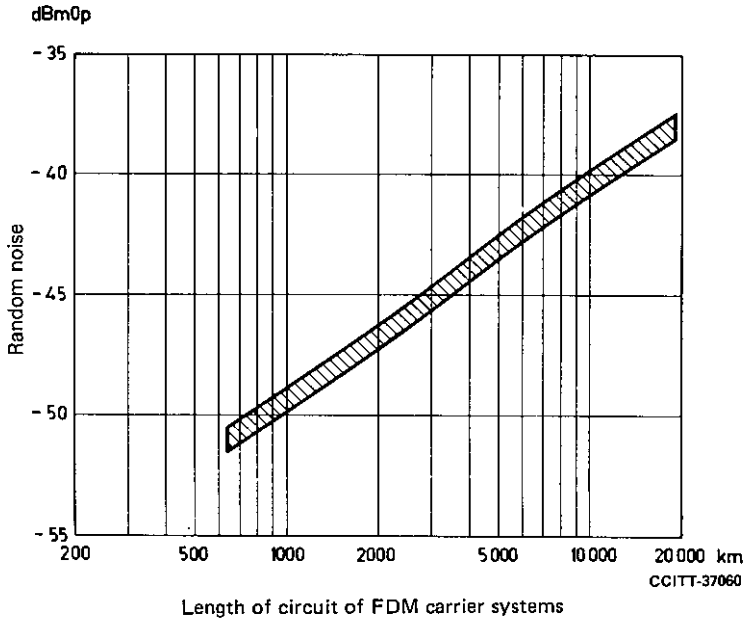

FIGURE A-1/M.1025

Random circuit-noise performance

Note – At the present time the section of the circuit provided by a satellite (between earth stations) employing FDM techniques contributes approximately 10 000 pW0p (–50 dBm0p) of noise. Therefore, for the purpose of determining maintenance limits for noise measurement on leased circuits, the length of this section may be considered to be equivalent to 1 000 km in Figure A-1/M.1025.

The contribution to noise of a circuit section provided by a satellite employing TDM technique remains as a subject for further study.

A.2 *Total distortion*

Table A-1/M.1025 is a guide to the signal-to-total-distortion ratio which may be found on circuits with different analogue section lengths and numbers of quantizing distortion units (QDU). When interpreting this table, particularly for circuits with long analogue sections, it should be noted that it may be possible to increase the number of QDUs in a circuit provided by the analogue sections contribute less noise than might be expected from Figure A-1/M.1025.

TABLE A-1/M.1025

Signal-to-signal distortion ratio using a sinusoidal signal at –10 dBm0

Type of circuit	Number of QDUs (Note)	Unit	Distance in analogue transmission (km)						
			< 320	321 to 640	641 to 1 600	1 601 to 2 500	2 501 to 5 000	5 001 to 10 000	10 001 to 20 000
Analogue	0	dB	43	41	38	36	33	30	28
Composite circuit	1	dB	34	34	33	32	31	29	28
	2	dB	32	31	31	31	29	28	28
	3	dB	30	30	30	29	28	28	28
	4	dB	29	29	28	28	28	28	28
	5	dB	28	28	28	28	28	28	28

Note – The number of QDUs contributed by various digital processes are given in Table 1/G.113 [7].

References

[1] CCITT Recommendation *9600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits*, Vol. VIII, Rec. V.29.

[2] CCITT Recommendation *Phase and amplitude hit counters for telephone-type circuits*, Vol. IV, Rec. O.95.

[3] CCITT Recommendation *Impulsive noise measuring equipment for telephone-type circuits*, Vol. IV, Rec. O.71.

[4] CCITT Recommendation *Phase jitter measuring equipment for telephone circuits*, Vol. IV, Rec. O.91.

[5] CCITT Recommendation *Quantizing distortion measuring equipment using a sinusoidal test signal*, Vol. IV, Rec. O.132.

[6] CCITT Recommendation *Equipment to measure non-linear distortion using the 4-tone intermodulation method*, Vol. IV, Rec. O.42.

[7] CCITT Recommendation *Transmission impairments*, Vol. III, Rec. G.113.

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