INTERNATIONAL TELECOMMUNICATION UNION

ITU-T G.614

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

TRANSMISSION MEDIA CHARACTERISTICS

CHARACTERISTICS OF SYMMETRIC PAIR STAR-QUAD CABLES DESIGNED EARLIER FOR ANALOGUE TRANSMISSION SYSTEMS AND BEING USED NOW FOR DIGITAL SYSTEM TRANSMISSION AT BIT RATES OF 6 TO 34 Mbit/s

ITU-T Recommendation G.614

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation G.614 was published in Fascicle III.3 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 G.614

CHARACTERISTICS OF SYMMETRIC PAIR STAR-QUAD CABLES DESIGNED EARLIER FOR ANALOGUE TRANSMISSION SYSTEMS AND BEING USED NOW FOR DIGITAL SYSTEM TRANSMISSION AT BIT RATES OF 6 TO 34 Mbit/s

(Melbourne, 1988)

1 Introduction

This Recommendation relates to symmetric pair star-quad cables which have been designed earlier and used to provide 60 or 120 carrier telephone channels of analogue transmission systems on each quad pair. Further, after reconstruction of the line, these cables are used for digital system transmission at bit rates of 6 to 34 Mbit/s. The cables concerned have no screened pairs and quads.

For digital transmission systems with a bit rate of 8 Mbit/s both one-cable and two-cable operations may be used. For systems with a bit rate of 34 Mbit/s two-cable operation is used only.

For digital transmission systems both several, or all cable pairs may be used.

2 Parameters to be measured

All parameters specified in Recommendation G.612, namely characteristic impedance, attenuation coefficient, far-end crosstalk between pairs on the same direction of transmission, and near-end crosstalk between pairs of two different cables intended for different directions of transmission are to be measured. If the cable is intended for use with both directions of transmission it is also necessary to measure the near-end crosstalk between pairs intended for different directions of transmission.

2.1 *Characteristics impedance*

The characteristics impedance is measured according to § 2.1 of Recommendation G.612.

2.2 *Attenuation coefficient*

The attenuation coefficient is measured according to § 2.2 of Recommendation G.612.

2.3 *Crosstalk*

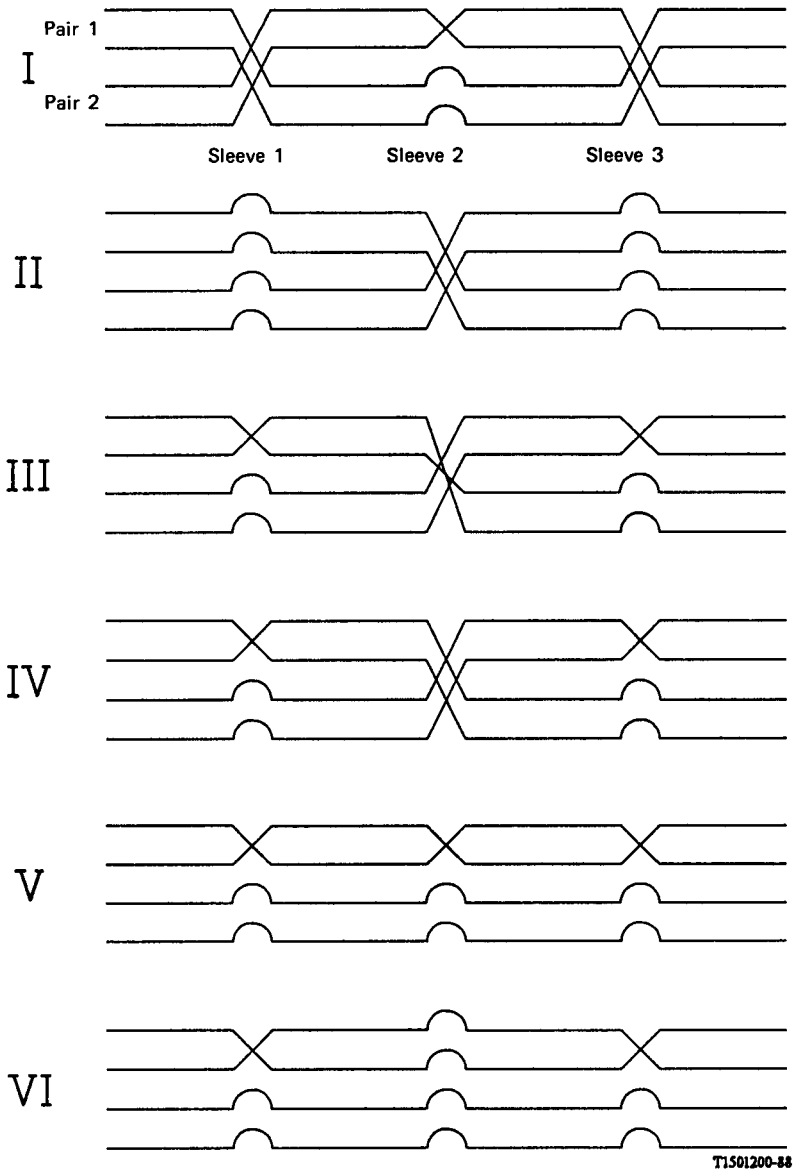
The crosstalk is specified in sinusoidal mode at a frequency near the timing half-frequency of the digital system and/or at other frequencies. Digital mode of measuring may be used also.

2.3.1 *Measurement of far-end crosstalk between pairs of different quads*

The measurement of the far-end crosstalk is carried out on pairs used in the same direction of transmission at a frequency above about 0.1 MHz when a length of cable is L. If the frequency of measurements differs from the timing half-frequency of the digital transmission system the value to be measured will be corrected to the factor $20 \log_{10} f$. The values are corrected to the length of 1000 m by the factor $10 \log_{10} L$.

2.3.2 *Measurement of far-end crosstalk between pairs of the same quad*

This measurement is carried out at a cable length equal to maximum permissible length of regenerator section of digital transmission system with bit rates of 6 to 34 Mbit/s at a frequency above about 1.0 MHz (measurement is carried out for each rate of digital transmission system separately) with systematic component of crosstalk in the same quad compensated. The compensation of systematic crosstalk component is carried out by one of the approximately equivalent transposition patterns (see Figure 1/G.614). When regenerator sections are of less length these methods of falling the elementary cable sections into separate parts and of transposition in quad provide the greater values of the far-end crosstalk between pairs than those values when measurements are carried out at, a maximum length of regenerator section.



Note 1 - Transposition pattern No. 1 was proposed by the Netherlands Administration in 1978 (see COM XV-135, period 1977-1980).

Note 2 - Transposition pattern No. 2 has been proposed by the German Democratic Republic Administration.

Note 3 - Transposition patterns Nos. 3, 4, 5 and 6 are proposed by the USSR Administration.

FIGURE 1/G.614

2.3.3 *Measurement of near-end crosstalk between pairs of the same or different cables intended for different directions of transmission*

This measurement is carried out either between pairs of the same cable (when one-cable operation is used), or between pairs of two different cables intended for different directions of transmission (when two-cable operation is used). The measurements are carried out both in sinusoidal and digital modes.

3 Cable specification

Administrations which decided to use cables designed earlier and used for analogue carrier systems with up to 120 channels in digital operation at bit rates 6 to 34 Mbit/s are recommended to choose cables with characteristics given in Tables 1/G.614 and 2/G.614.

3.1 *Tables used for digital transmission systems with bit rates of 6 to 8 Mbit/s in one-cable operation*

See Table 1/G.614.

TABLE 1/G.614

Characteristics	Requirements		
Types of cable	I (Note 1)	II (Note 1)	III (Note 1)
Operational bit rate C, kbit/s	8448	8448	8448
Line code	HDB-3	HDB-3	HDB-3
Modulation rate, kbaud	8448	8448	8448
Tolerate attenuation of regenerator section at a frequency of C/2 when pairs of cable are of maximum use and directions of transmission are set in different quads (maximum permissible value), dB	23	23	45 (Note 3)
Diameter of copper conductor, mm	1.2	1.2	1.3
Previous cable operating range	HF	HF	AF, HF
Type of insulation	P1	P1	P1, P
Number of star quads	4	7 (Note 2)	3, 4, 8
Characteristic impedance at 1 MHz, ohms	165	165	170
Nominal capacity, nF/km	24.5	24.5	21.0
Attenuation coefficient, dB/km at 10°C			
- at 1 MHz	4.8	4.5	3.7
-at a frequency C/2	10.6	9.7	8.0
Near-end crosstalk at a frequency of C/2, dB			
-mean value	48	50	50
-minimum value	34	34	44
Far-end crosstalk between pairs of different quads (minimum value referred to 1,000 m), dB			
- at 1 MHz	54	54	60
- at a frequency of C/2	42	42	48
Far-end crosstalk between pairs of the same quad (minimum value at regenerator section of maximum length), dB			
- at 1 MHz	60	60	60
- at a frequency of C/2	43	43	48

Note 1 - These characteristics relate to cables with aluminium covering.
Note 2 - Central quad not used for digital system transmission.
Note 3 - Regenerators of the transmission direction B-A installed in midpoint of the section of the opposite direction A-B.

HF High-frequency
AF Audio-frequency
Pl String polysterene
P Paper

3.2 *Cables used for digital transmission systems with bit rates of 6 to 34.368 Mbit/s in two-cable operation*

See Table 2/G.614.

TABLE 2/G.614

Characteristics	Requirements		
Type of cable	I (Note 1)	II (Note 1)	III (Note 1)
Operational bit rate C, kbit/s	8448	34 368	34 368
Line code	HDB-3	5B6B	5B6B
Modulation rate, kbaud	8448	41 242	41 242
Attenuation of regenerator section at a frequency of C/2 when all pairs of cable are used (maximum permissible value), dB	70	85	85
Diameter of copper conductor, mm	1.2	1.2	1.3
Number of star quads	4	4	3, 4, 8
Characteristic impedance at 1 MHz, ohms	165	165	170
Nominal capacity, nF/km	24.5	24.5	21.0
Attenuation coefficient, dB/km at 10°C			
- at 1 MHz	4.8	4.8	3.7
- at a frequency C/2	10.6	24.0	17.0
Far-end crosstalk between pair of different quads (minimum value referred to 1,000m), dB			
- at 1 MHz	54	51	60
- at 4 MHz	42	42	48
- at 12 MHz	-	32	30
- at 17 MHz	-	30	26
Far-end crosstalk between pairs of the same quad (minimum value at a regenerator section of maximum length), dB			
- at 1 MHz	42	-	60 (Note 3)
- at 4 MHz	30	33 (Note 2)	48 (Note 3)
- at 12 MHz	-	17 (Note 2)	27 (Note 3)
- at 17 MHz	-	13 (Note 2)	17 (Note 3)

Note 1 - These characteristics relate to cables with aluminium covering.

Note 2 - These values are obtained by means of transposition pattern No. 5 (see Figure 1/G.614) for four cable lengths (0.825 km).

Note 3 - These values are obtained by means of transposition pattern No. 2 (see Figure 1/G.614).