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**General rules of transmitting and
receiving modules for low speed
fiber optic transmission**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently JIS C 6110:1990 is replaced with JIS C 6110:1997.

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General rules of transmitting and receiving modules for low speed fiber optic transmission

Introduction This Standard specifies general rules of transmitting and receiving modules for low speed fiber optic transmission with 2 R (waveform reproducing and shaping) functions, which are used for transmission of NRZ digital signal at a bit rate not exceeding 10 Mb/s through a multimode optical fiber, in response to the requirements of early establishment of national standard in such backgrounds, that the market of fiber optic transmission link inside and outside of the country is speeding and international standardization activity is promoted.

1 Scope This Japanese Industrial Standard specifies general matters such as terms, symbols, classification, max. ratings and performances of transmitting and receiving modules for low speed fiber optic transmission with waveform reproducing and shaping functions which are used for transmission of NRZ digital signal at a transmission rate not exceeding 10 Mb/s through a multimode optical fiber.

Remarks 1 The transmitting and receiving module for low speed fiber optic transmission dealt with here means a module composed of a transmitter consisting of a light emitting diode as the light emitting element, an electronic circuit and a joint with the optical fiber and a receiver consisting of a light receiving element, an electronic circuit and a joint with the optical fiber. It is the generic name of modules of the following three kinds in construction.

- a) Transmitting module in which the above transmitter is employed as an individual module.
- b) Receiving module in which the above receiver is employed as an individual module.
- c) Transmitting and receiving module in which the above transmitter and receiver are employed to form a module.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS C 0301 *Graphical symbols for electrical apparatus*

JIS C 6111 *Measuring methods of transmitting and receiving modules for low speed fiber optic transmission*

3 Definitions For the purpose of this Standard the following definitions shall apply :

- a) **absolute maximum ratings** The limit value which shall not be exceeded even in an

instant. Any one of the values specified in standards shall not exceed this limit.

- b) **storage ambient temperature (T_{stg})** The permissible ambient temperature when neither the supply voltage nor signal voltage is applied.
- c) **operating temperature (T_{op})** The ambient temperature [operating ambient temperature, $T_{op}(a)$] or the case temperature [operating case temperature $T_{op}(c)$] at which the operation of module is ensured when the specified supply voltage and input signal are applied.
- d) **case temperature (T_c)** The temperature at the specified position of the case.
- e) **supply voltage** The voltage which is supplied to operate the module.
- f) **data input voltage (V_1)** The voltage of signal which is to be inputted across the signal input terminals.
- g) **data input current (I_1)** The current of signal which is to be inputted through the signal input terminals.
- h) **transmission bit rate** The amount of information (number of bits) to be transmitted per unit time. It is normally express in the unit of bit/second (b/s).
- i) **transmission distance** The maximum distance at which a signal of the specified mark density can be transmitted without exceeding the specified bit error rate.
- j) **output optical power (P_f)** The average value of optical power which is taken out from the optical output end of a transmitter. It is expressed in the unit of dBm. When the peak value is taken, such a fact shall be clearly stated. The optical power in the unit of dBm is expressed by the following formula :

$$P_f (\text{dBm}) = 10 \log_{10} P$$

Where, P : output optical power expressed in the unit of mW

P_f : output optical power expressed in the unit of dBm

- k) **peak emission wavelength (λ_p)** The wavelength at which the optical output becomes the maximum.
- l) **spectral radiation bandwidth ($\Delta\lambda_w$)** The width (full width) in spectrum spread between two wavelengths at which the optical power is the specified rate to that at peak emission wavelength. The spreading width (full width) at which the optical power is 50 % of the maximum peak is called spectral half width ($\Delta\lambda$). The spectral half width is also called FWHM (full width half max.).
- m) **maximum received optical power ($P_{I\max}$)** The maximum value of average value of input optical power which can be received at the specified bit error rate under the specified operating conditions. It is expressed in the unit of dBm. When the peak value is taken, such a fact shall be clearly stated.
- n) **minimum received optical power ($P_{I\min}$)** The minimum value of average value of input optical power which can be received at the specified bit error rate under the specified operating conditions. It is expressed in the unit of dBm. When the peak

taken, such a fact shall be clearly stated.

- o) **regenerating** To reproduce the output signal at the transmitter by removing the distortion and noise from the input signal at the receiver.
- p) **reshaping** To produce the original input signal at the transmitter from the regenerated signal by means of a linear or nonlinear circuit.
- q) **pulse width (t_w)** The duration of pulse. Unless otherwise specified it means the time from the point at which the optical power is one half of the max. (half-value point) in the front edge of pulse to that in the rear edge.
- r) **pulse width distortion (Δt_w)** The difference between the pulse width of the waveform of optical output at the transmitter or of electrical output at the receiver, and the pulse width of the reference waveform.
- s) **random jitter (Δt_j)** The irregular fluctuation or its amount of the pulse width on the time axis. The fluctuation of phase or transition point due to random pattern of signal from its transition point or sign pattern of signal, in a section of ideal pulse width without fluctuation. The fluctuation at relatively low frequency due to variation of mark density from among random jitter is especially called wanda.
- t) **non return to zero (NRZ)** A signal string in which all the bit sections are at "high level" when the data are "1", and are at "low level" when the data are "0".
- u) **positive logic** Such a logic that the optical output is "operating" when the electric input data are "1" and the optical output is "non-operating" when the electric input data are "0" in the transmitter; or in the receiver the electric output data are "1" when the optical input is "operating" and the electric output data are "0" when the optical input is "non-operating".
- v) **negative logic** Such a logic that the optical output is "operating" when the electric input data are "0" and the optical output is "non-operating" when the electric data are "1" in the transmitter ; or in the receiver the electric output data are "0" when the optical input is "operating" and the electric output data are "1" when the optical input is "non-operating".
- w) **rise time (t_r)** The time necessary for the optical output pulse at the transmitter or the electrical output pulse at the receiver, to increase from 10 % to 90 % of the pulse amplitude.
- x) **fall time (t_f)** The time necessary for the optical output pulse at the transmitter or the electrical output pulse at the receiver, to decrease from 90 % to 10 % of the pulse amplitude.
- y) **transmission delay time (t_d)** The delay time of the output signal from the input signal expressed by the difference between the half-value points of both signals.
- z) **electrical input interface** The electrical connection boundary where the input signal into the transmitter is represented by a value of voltage or current.
- aa) **electrical output interface** The electrical connection boundary where the output signal from the receiver is represented by a value of voltage or current.