App_Note：
Optical Module Test
with
INSTELENT E5010 and T5001/ T5002

Version	Data	Version description	Author
V1.0	2005.12.15	New	Kelly

Chengdu Instelent Technology Co.

Introduction

E5010 integrates the function of pattern generating and checking; it has low jitter output and can be used to demarcate the performance of optical modules and components. E5010 supports rate from 155Mbps to 3Gbps (Or other customized rates), and supports multi-standard test patterns.

At the same time, E5010 supports several channels: SFP and CH1 are for general-purpose; the CH2 is used for extended-purpose. SFP channel can achieve the input/output of optical signal; CH1/CH2 channel can achieve the input/output of electrical signal. Every channel has its own data input, data output and clock output (Synchronized with data output), and every channel's data and clock can turn on or off respectively.

In the BER test, E5010 is used for a pattern generator, which can generate multi-standard pattern at different rate. With different test boards provided by INSTELENT, E5010 can indicate the BER feature of the module in real time.

In the eye pattern test, E5010 is used for a pattern generator, which can generate multi-standard pattern at different rate. With different test boards provided by INSTELENT can test the eye pattern character of SFP, GBIC, SFF, 1x9 (Eye Pattern Analyzer or High Performance Oscilloscope is needed in eye pattern test.).

The test boards provided by INSTELENT have the power supply switch of 3.3V and 5V.

This application note illustrates many kinds of schemes for the optical module test. In these schemes, the settings of E5010 can find in E5010 Operation Manuel provided by INSTELENT.

In the following kinds of schemes, you should be careful that the in-phase and reverse-phase end are under right connection. When you can connect either end of them in some case, the other end should be terminated with a 50Ω resistor.

The optical modules that can be tested include the following ones: GBIC, SFP, SFF2x5, SFF2x6, SFF2x10 and 1x9. How to choose the right test board can find in appendix 3.1.

DUT is an acronym for Device Under Test. Every test board provides two kinds of optical module socket, the detail can find in appendix 3.2.

1. Test the error bit performance of modules

We recommend that the output of CH1 clock should be set OFF.

1.1 Test the TX performance of optical module

In the scheme, the primary equipment is pattern generator and checker—E5010 of INSTELENT. With the corresponding test board provided by INSTELENT, you can test the BER performance of the optical module transmitter.

The principle of this scheme is as follows: The pattern generated by E5010 arrives at SMA input port of DUT X on the TB via RF cable, and then arrives at DUT X which is the module under test. Then the pattern, via fiber, will be transferred to another optical module Y that located at the other DUT socket. Traveling from SMA output port of DUT Y to input port on E5010 via the RF cable, the pattern will be considered as the input signal of BERT. Considering the convenience of test, we recommend that optical module Y should be the excellent one.

In this scheme, E5010's CH1 channel is employed. The obligatory settings are the following two items: "CH1: DOUT → ON"; "BERT FROM → CH1, BERT TO → CH1".

If you want to test the performance of error bit by tuning the power of optical signal, please add the adjustable attenuator.

Figure 1 illustrates the scheme (TB denotes the Test Board provided by INSTELENT.).

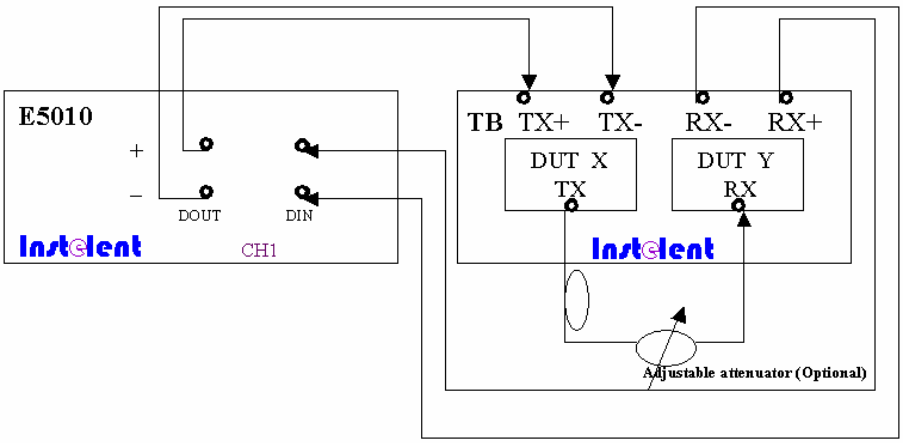

Figure 1 Test the TX of module

1.2 Test the RX performance of optical module

In the scheme, the primary equipment is pattern generator and checker—E5010 of INSTELENT. With the corresponding test board provided by INSTELENT, you can test the receiver's performance of optical module.

Using the T500x in the scheme, DUT is inserted in the corresponding socket. For your convenience in the test, please choose a SFP module with excellent

performance and connect it with the SFP socket of E5010.

The principle of this scheme is as follows: the optical signal from SFP arrives at DUT X through the fiber, and then travels from the output port of DUT X to the input port of E5010's CH1 via RF cable. The signal is treated as the input of BERT.

In this scheme, E5010's SFP and CH1 channel are employed. The obligatory settings are the following two items: "SFP: DOUT → ON"; "BERT FROM → SFP, BERT TO → CH1".

Figure 2 illustrates this scheme (TB denotes the Test Board provided by INSTELENT.).

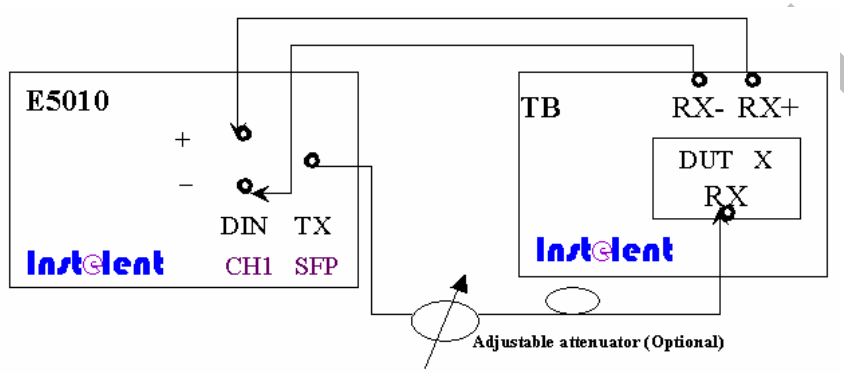

Figure 2 Test the RX of module

The scheme illustrated in Figure 2 also can be used for the sensitivity test of receivers. During BER test, under a certain BER, tune the attenuator and make the light received by DUT X minimum. Then use the optical power meter, the sensitivity of the component is gotten.

1.3 Test the performance of TX together with RX

In the scheme, the primary equipment is pattern generator and checker—E5010 of INSTELENT. With the corresponding test board provided by INSTELENT, you can observe synchronously the BER performance of transmitter and the sensitivity of receiver of the optical module under test.

The principle of this scheme is as follows: The pattern generated by E5010 arrives at the SMA input port of DUT X via RF cable; X is the module under test. The signal will be transferred to the receiver of X through fiber, after traveling from SMA output port of X to input port of E5010 via RF cable, the pattern will be considered as the input of test. If you want to test the performance of BER by varying the optical power, please add the adjustable attenuator.

In this scheme, E5010's CH1 channel is employed. The obligatory settings are the following two items: "CH1: DOUT → ON"; "BERT FROM → CH1, BERT TO → CH1".

Figure 3 illustrates this scheme (TB denotes the Test Board provided by INSTELENT.).

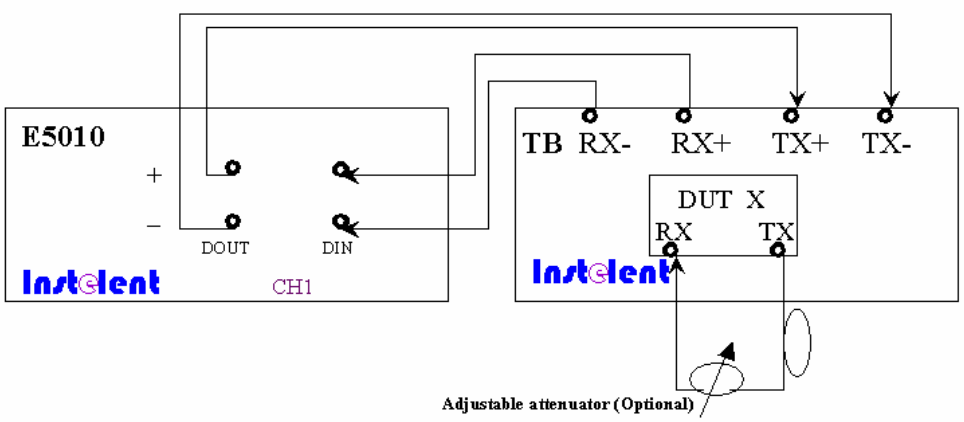

Figure 3 Test the TX and RX synchronously

2. Test the eye pattern of module (Other equipment is needed)

2.1 Test the optical eye pattern of TX

In the scheme, the primary equipment is pattern generator and checker—E5010 of INSTELENT. With the test board provided by INSTELENT and Eye Pattern Analyzer or High Performance Oscilloscope, you can observe the eye pattern performance of the optical module transmitter, and then educe the jitter feature and extinction ratio.

The principle of this scheme is as follows: The pattern generated by E5010 via RF cable arrives at the SMA input port of DUT X, which is the module under test. Traveling from the output of X to the external O/E conversion device via fiber, which can be omitted if the Eye Pattern Analyzer or High Performance Oscilloscope has the optical interface, the pattern will be considered as the input of test. You can observe the eye pattern of module under test through the Eye Pattern Analyzer or High Performance Oscilloscope.

The most important point is that the Trigger port of Eye Pattern Analyzer or High Performance Oscilloscope should be connected to the either clock port of E5010's CH1 (In the following illustration, the connected port is "—".).

In this scheme, E5010's CH1 channel is employed. The obligatory settings are the following two items: "CH1: DOUT → ON "; "CH1: COUT → ON ".

Figure 4 illustrates this scheme (TB denotes the test board provided by INSTELENT.).

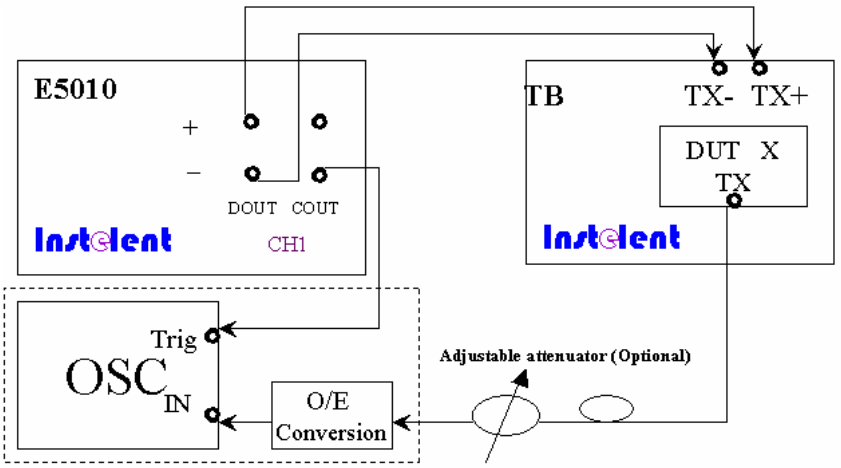

Figure 4 Test the eye pattern of TX

The devices in dashed pane denote equipments that need to add on: Eye Pattern Analyzer or High Performance Oscilloscope, external O/E conversion device that can be omitted if the Eye Pattern Analyzer or High Performance Oscilloscope has optical interface.

2.2 Test the electrical eye pattern of RX

In the scheme, the primary equipment is pattern generator and checker—E5010 of INSTELENT. With the corresponding test board provided by INSTELENT and Eye Pattern Analyzer or High Performance Oscilloscope, you can observe the electrical eye pattern of the optical module.

The principle of this scheme is as follows: The optical signal from E5010's SFP via fiber arrives at the DUT X. Then traveling via RF cable from the SMA output of DUT X to the input port of Eye Pattern Analyzer or High Performance Oscilloscope, the signal will be treated as the input of test.

The wavelength of SFP and DUT X should be coincident.

The most important point is that the Trigger port of Eye Pattern Analyzer or High Performance Oscilloscope should be connected to the clock output of the E5010's SFP.

In this scheme, E5010's SFP channel is employed. The obligatory settings are the following two items: "SFP: DOUT → ON "; "SFP: COUT → ON ".

Figure 5 illustrates this scheme (TB denotes the test board provided by INSTELENT.).

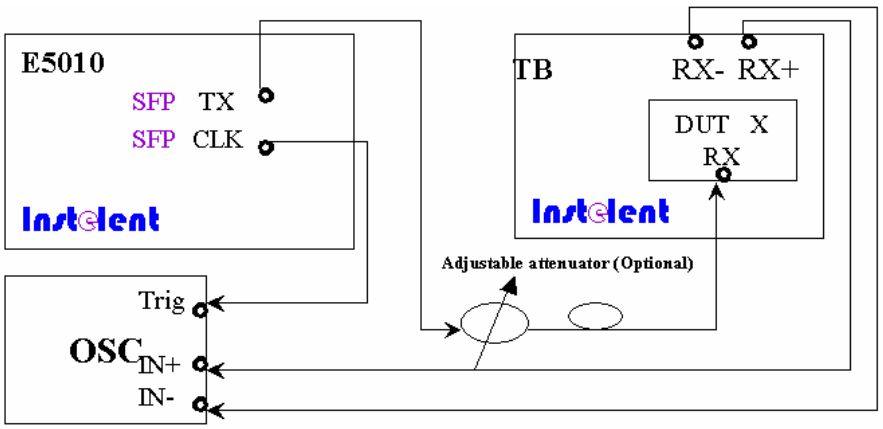

Figure 5 Test the eye pattern of RX

3. Appendix

3.1 How to choose the test board

INSTELENT provides several different kinds of test boards for different kinds of optical modules. At present, we can furnish three kind test boards: T5001, T5002, and T5003.

T5001 is used for the GBIC and SFP modules test.

T5002 is used for the 1x9, SFF2x5, SFF2x6 and SFF2x10 modules test.

T5003 is used for the optical components test, such as the PIN-TIA and APD-TIA.

3.2 DUT socket on the test board

The DUT socket on T5001 is for GBIC and SFP modules.

The DUT socket on T5002 is for 1x9, SFF2x5, SFF2x6 and SFF2x10 modules.

The detailed position of test board can find in <Test board operational manual>.

3.3 How to choose the pattern and rate

When test the optical modules and components applied in Ethernet, we suggest you choose the PRBS 2^7-1.

When test the optical modules and components applied in SDH, SONET and ATM, we suggest you choose the PRBS 2^{23}-1.

The rate of E5010 should conform to the optical modules and components

under test.

4. Abbreviation

CH1: The channel 1.

CH2: The channel 2.

COUT: The output of clock signal.

DIN: The input of data.

DUT: An acronym for Device Under Test.

DOUT: The output of data.

E5010: The primary equipment in test.

OSC: An acronym for Optical Supervise Channel.

RX: The receiver of module.

SFP: An acronym for Small Form Factor Pluggable.

SFF: An acronym for Small Form Factor.

TB: An acronym for Test Board.

Trig: The trigger port of Eye Pattern Analyzer or High Performance Oscilloscope.

TX: The transmitter of module.

＋: The in-phase port of differential input or output.

－: The reverse-phase port of differential input or output.

Note: If you have any question, please contact INSTELENT.

Chengdu Instelent Technology Co., Ltd.
Add: Room 513, Information Industry Building, No.159, 1st Eastern Section of Yihuan Road, Chengdu, Sichuan, China
Tel: +86-28-83206787 Fax: +86-28-83206757
WWW.INSTELENT.COM