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Brief Introduction of the Infrared Transmission

The Infrared Communication belongs to a kind of the wireless communication technology; it is no need to connect with the hardware. Easy use and low cost , the Infrared Communication is widely used for the data transmission among the mobile phones, computers and PDAs or the remote controllers of the home appliance, such as televisions and air conditioners. However, the infrared is not suitable for obstacles place; The reason of its transmission distance is very short and the transmission speed is not high, so there are many limitations on the actual application.

In order to integrate the questions of the communication transmission among devices, the IrDA (Infrared Data Association) has been established in 1993, which aims at constituting the unified infrared communication standard. And the IrDA1.0 specifications have been issued in 1994.
Besides the IrDA specifications, there are some other infrared specifications, which are used for the infrared products on the current market. And those specifications are developed by some manufacturers, such as PD6122 of NEC, RC-5 and RC-6 of Philips.

The Infrared Decoding Modules, which are developed by Zeroplus Technology, can support the Infrared Transmission Decoding. The instructions are described one by one as below.
The IRDA Decoding Module of the Zeroplus Technology Logic Analyzer can analyze the IrPHY layer of the IrDA specifications, which is the physical layer of the infrared communication technology. The IrPHY includes the following items.

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IRDA SIR

The Baud Rate of the IRDA SIR is between 2.4Kbps and 115.2Kbps, and it adopts the Standard Asynchronous Transmission to transmit the signal. The signal format is START (1 bit, Logic 0), DATA (8 bits) and the STOP (1 bit, Logic 1) in sequence. The signal encoding adopts RZ Encoding. Specifically, the Logic 0 is denoted by Pulse, whose width is 3/16 of one bit (when the Baud Rate is 115.2Kbps, the Pulse Width is 1.63us), and the Logic 1 is denoted when there is not a pulse signal (see Figure 1). It is noticed that the signal generator never transmits any signal during each transmission process and the transmission begins at the START each time. In addition, the IRDA1.1 format specifies the SIR-B mode, that is to say, no matter what the Baud Rate is, the fixed pulse width, 1.63us, will be kept.

Figure 2 is the IRDA SIR Configuration Dialog Box, and the Baud Rate and the Pulse Width of the current signal can be inputted in the Configuration dialog box.

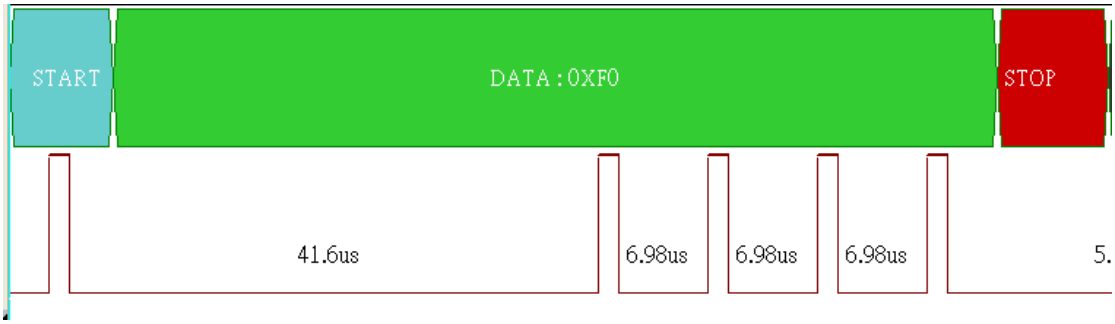

Figure 1: IRDA SIR Packet Format

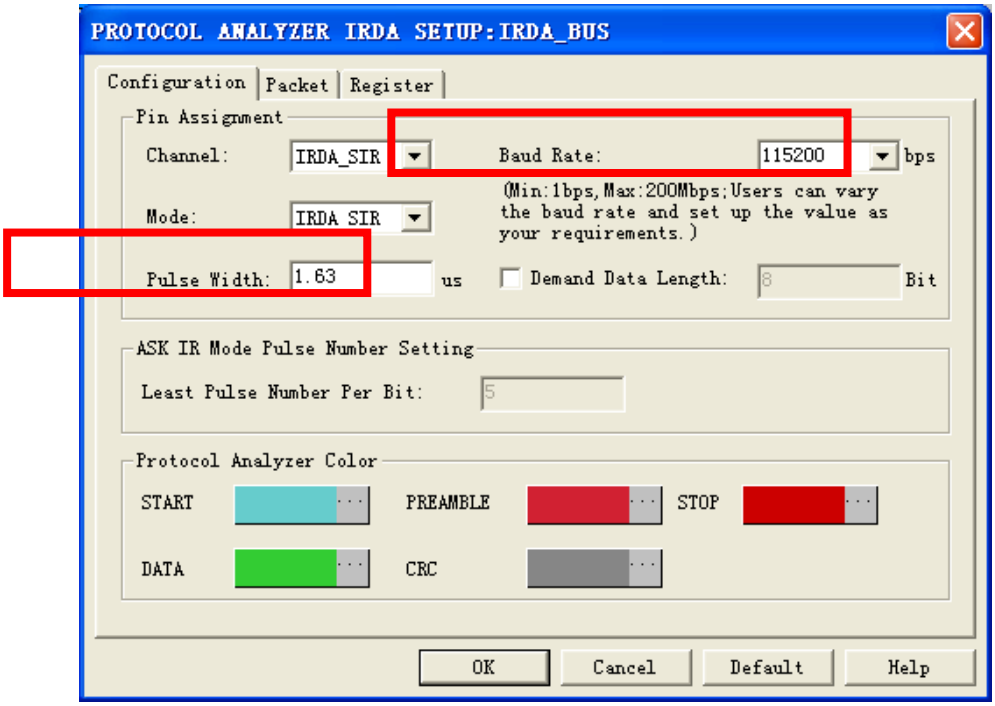

Figure 2: IRDA SIR Configuration Dialog Box

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ASK(OOK) IR

The Baud Rate of the ASK(OOK) IR is between 9.6Kbps and 57.6Kbps, and it also adopts the Asynchronous Transmission mode. But the used encoding mode is RZ Encoding with the carrier. Specifically, the Logic 0 is denoted when there is a 500KHz pulse signal transmitted, and the Logic 1 is denoted when there is not a pulse signal.

With the help of the Zeroplus Logic Analyzer, the Least Pulse Number Per Bit can be set to enhance the correctness of analyzing signals in the ASK IR Configuration dialog box.

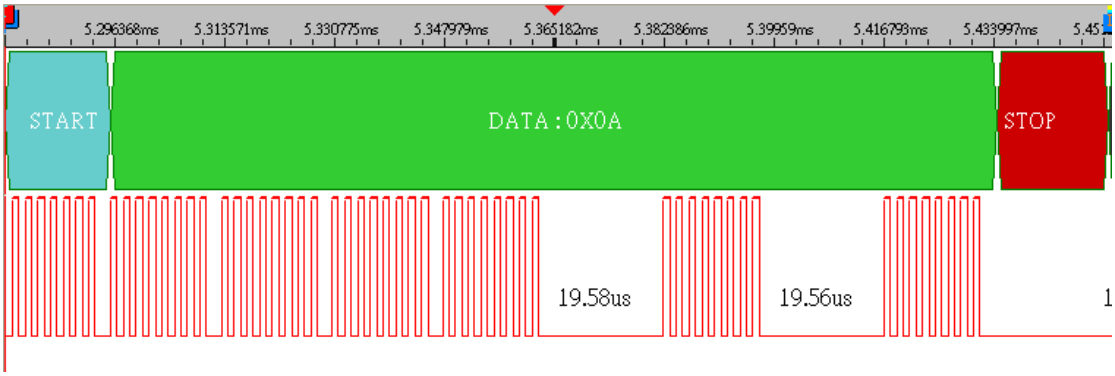

Figure 3: ASK IR Packet Format

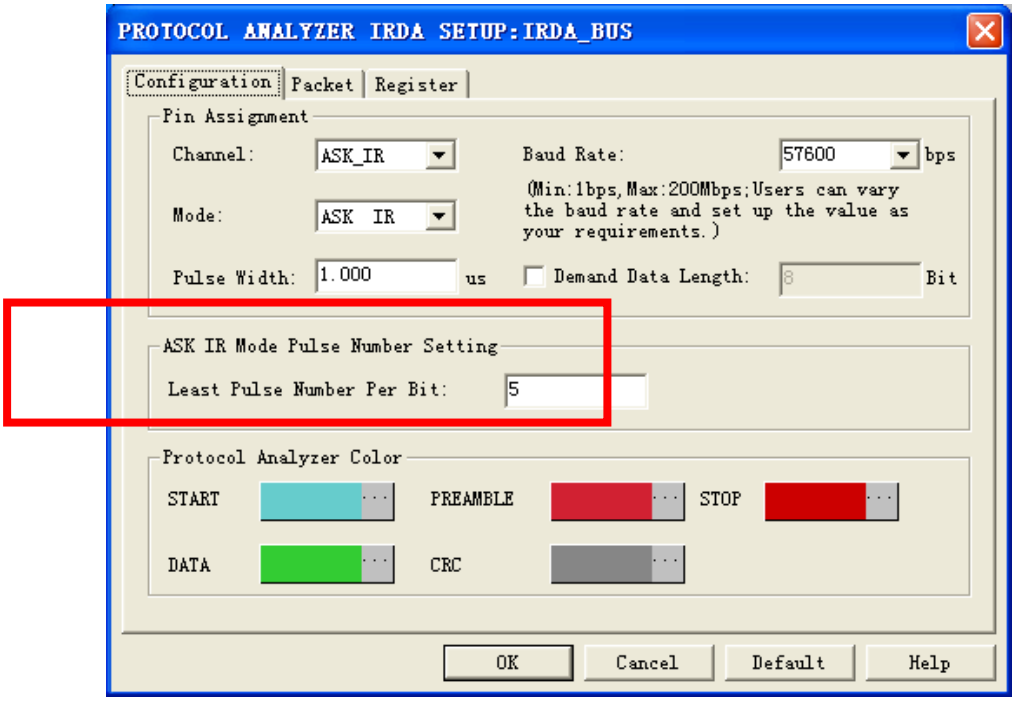

Figure 4: ASK IR Configuration Dialog Box

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IRDA HDLC

The Baud Rate of the IRDA HDLC is between 0.567Mbps and 1.152Mbps, and it also adopts the Asynchronous Transmission mode. Its encoding mode is similar to that of the IRDA SIR (Logic 0 is denoted when there is a pulse signal, and Logic 1 is denoted when there is not a pulse signal), but the pulse width is 1/4 of one bit. The format of the data frame conforms to the HDLC protocol. The START and STOP of the data frame are 01111110; the Bit Filling Mechanism can be used to deal with the continuous six 1 in the data frame. That is to say, the six 1 can not appear in the transmitted data frame simultaneously. In addition, a 16bits CRC is added in each data frame to control the integrality of the data. The Demand Data Length can be varied according to users' requirements in the IRDA HDLC Configuration dialog box.

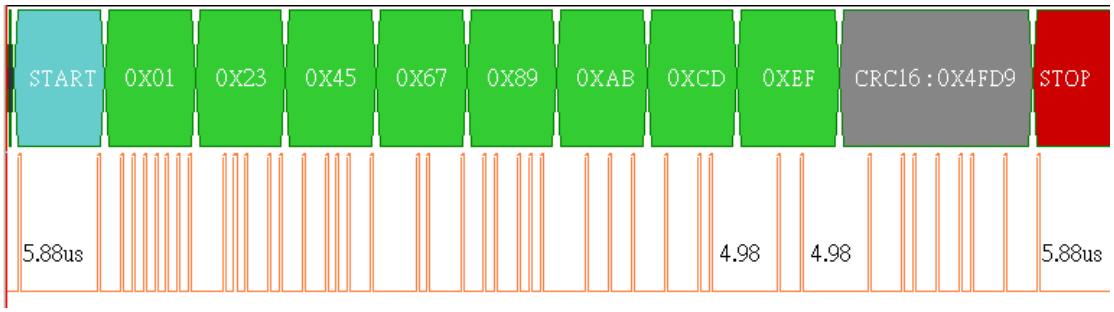

Figure 5: IRDA HDLC Packet Format

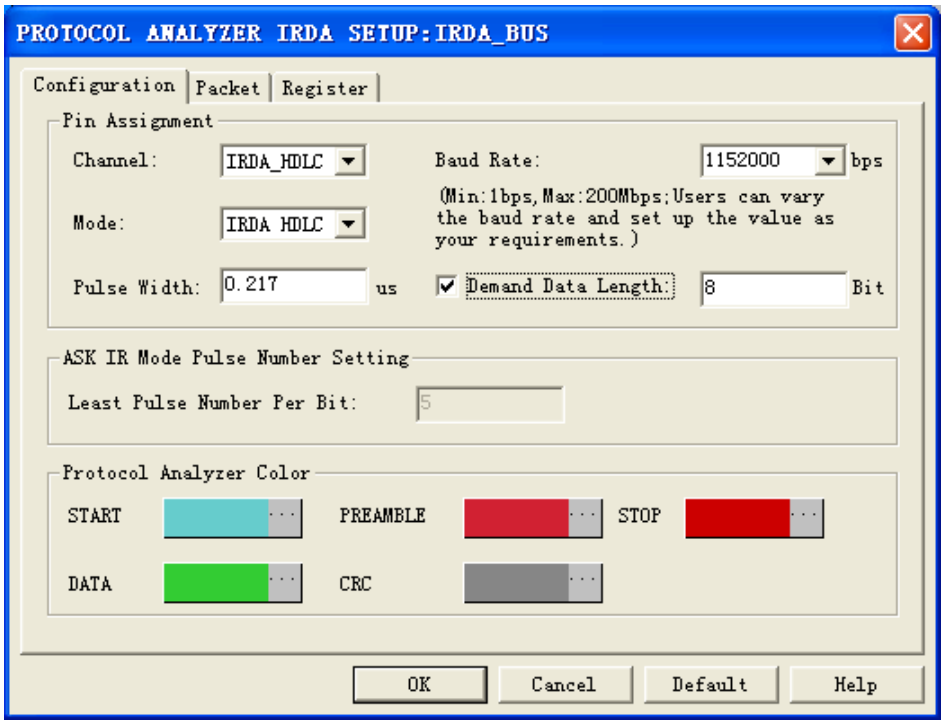

Figure 6: IRDA HDLC Configuration Dialog Box

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IRDA FIR

IRDA FIR is also called IRDA 4PPM. Its Baud Rate is 4Mbps, and it adopts the Synchronous Transmission mode. But the encoding mode is rather complex; each pair of adjacent bits is encoded by the position pulse code. That is to say, “00”is encoded as 1000(0X08); “01” is encoded as 0100(0X04); “10” is encoded as 0010(0x02); “11” is encoded as 0001(0x01) (each group consists of four bits; the “1” denotes that the pulse will be sent out at the quarter of the time, when the setting of the pulse width is satisfied). Compared with the before-described encoding mode, the encoding mode can make the LED reduce more than half of the switch frequency. The consistency of the average frequency of the received pulse can make the receiver more suitable for the outside light. In addition, there is a 32bits CRC added in each data frame to control the integrality of the data. Besides the data frame, there must be the PREAMBLE, START and STOP in the packet, which are different from the data frame. Hereinto, the PREAMBLE is defined as sixteen codes, namely, 1000 (0X08), 0000 (0X00), 1010 (0X0A) and 1000 (0X08); the START is defined as thirty-two codes, namely, 0000 (0X00), 1100 (0X0C), 0000 (0X00), 1100 (0X0C), 0110 (0X06), 0000 (0X00), 0110 (0X06) and 0000 (0X00); the STOP is defined as thirty-two codes, namely, 0000 (0X00), 1100 (0X0C), 0000 (0X00), 1100 (0X0C), 0000 (0X00), 0110 (0X06), 0000 (0X00) and 0110 (0X06).

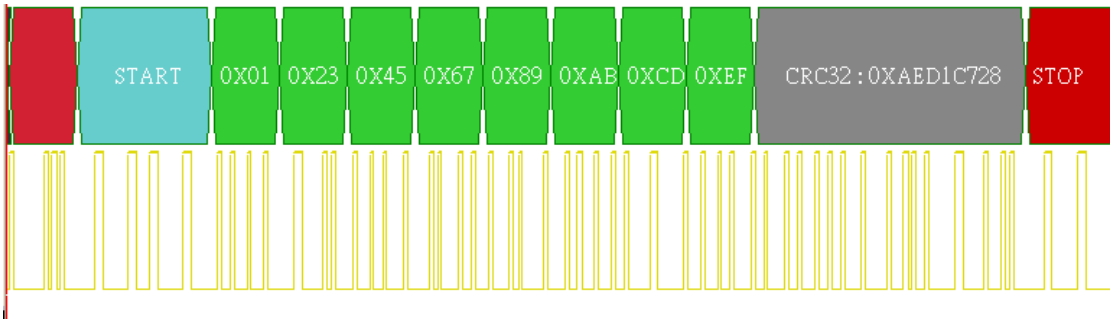

Figure 7: IRDA FIR Packet Format

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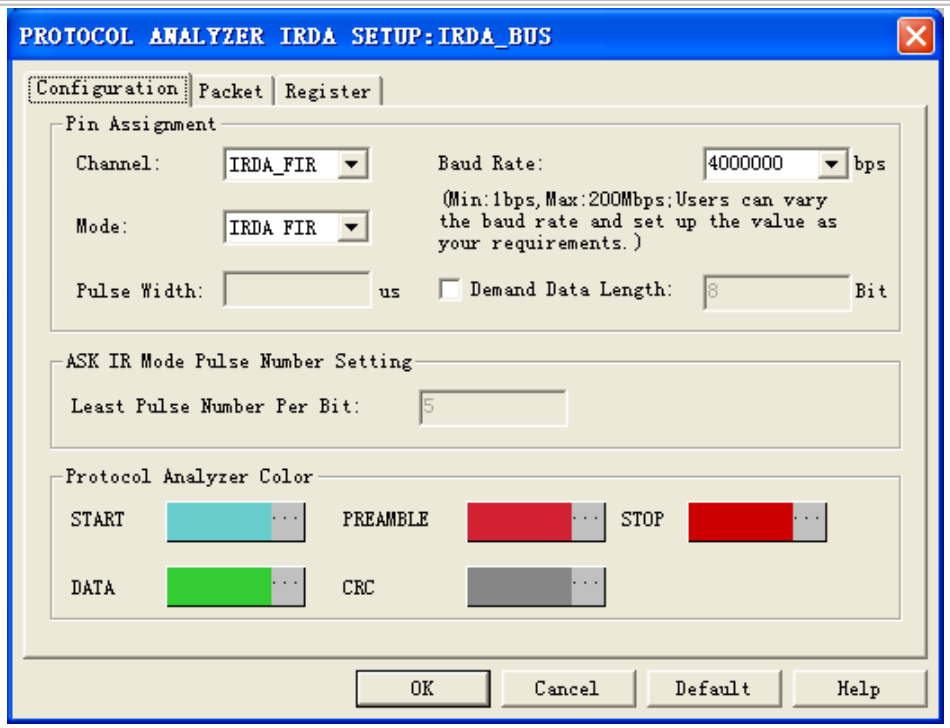

Figure 8: IRDA FIR Configuration Dialog Box

Besides the IrPHY, there are other kinds of IrDA specifications.

IrLAP

IrLAP is the Link Access Protocol Layer of the infrared communication technology., The HDLC protocol is modified to be suitable for the infrared communication, which is the IrLAP. When there are more than two devices, only one device is designated
as the Master, and the other devices are used as the Slave. It adopts the half-duplex mode to transmit the signal. The IrLAP is used to describe the program which is founding, numbering and ending the link. At the beginning of founding the link, the Baud Rate is 9600bps, and then the Baud Rate between the two devices is changed to be the supported highest speeds (9.6Kbps, 19.2Kbps, 38.4Kbps or115.2Kbps).

IrLMP

IrLMP is the Link Management Protocol Layer of the infrared communication technology and it lies on top of the IrLAP layer. The IrLMP is used by one device to inform other devices which are in the valid range of the device that it is here, that is to say, the link configurations can be changed by moving in or out a device. And the IrLMP functions as detecting the functions of the device, dealing with the data string, and supplying multitasking on condition that the multidevice supply the access structure.

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Tiny TP

Tiny TP is the Transport Protocol Layer of the infrared communication technology, and it is similar to the TCP protocol. The Tiny TP functions as supplying the virtual channel service among the devices, dealing with the error, packing the data into a packet, and grouping the packets into the original data.

IrLAN

IrLAN supplies the function of accessing the Local Area Network; it is allowed to transmit the DATA FRAME of the Ethernet and the Token Ring. When the infrared is desired to access the Local Area Network, it is necessary to use the IRDA interface, the device which is used to connect to the network server and the client operating software.

IrOBEX

IrOBEX is the Infrared Object Exchange Protocol Layer; it lies on top of the Tiny TP layer. It utilizes the GET and PUT command to exchange the binary data between devices.

Besides the IrDA specifications, there are some other infrared specifications, which are used for the infrared products on the current market. And those specifications are developed by some manufacturers, such as PD6122 of NEC, RC-5 and RC-6 of Philips. Zeroplus Logic Analyzer also supports those infrared transmission decodings.

Brief Introduction of the NEC PD6122

A complete NEC PD6122 code includes HEADER code, CUSTOM code, DATA code and /DATA code); see the Figure 9.

Figure 9: NEC PD6122 Packet Format

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The encoding mode of the NEC-IR is using the status and the length of the carriers to display the positive and negative logic statuses . The code of the Logic 0 consists of a segment of carrier and a rather short period of idle time, and the code of the Logic 1 consists of a segment of carrier and a rather long period of idle time; the time length has the strict regulations. The carrier consists of the pulse with the fixed frequency.

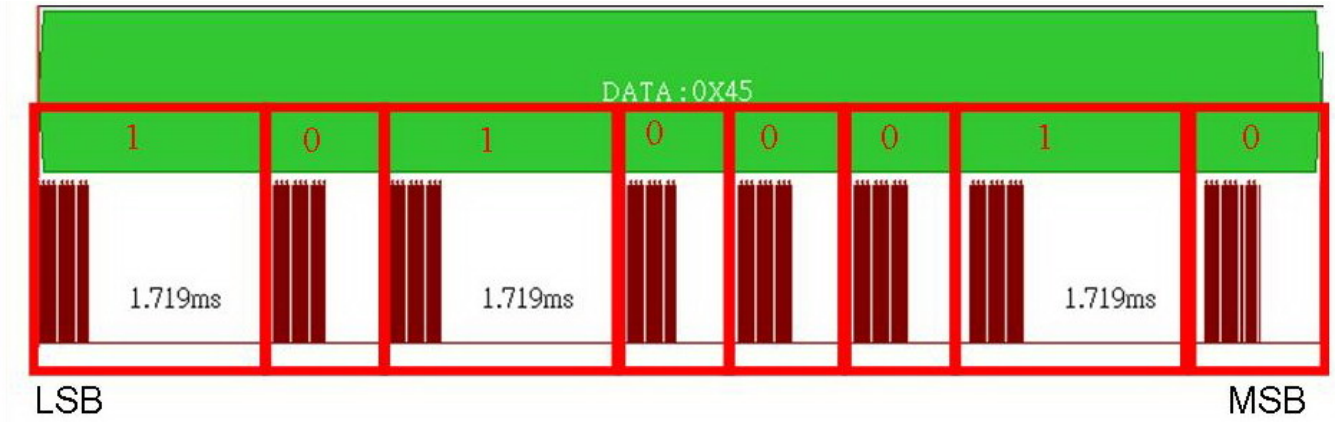

Figure 10: NEC PD6122 Data Packet

The decoded data from MSB to LSB is “01000101＝0X45”; see the Figure 10.
When the NEC PD6122 decoding module of Zeroplus Logic Analyzer is used, it only needs to set the Carrier Period in the NEC PD6122 Configuration dialog box; the signal can be decoded through the software automatically.

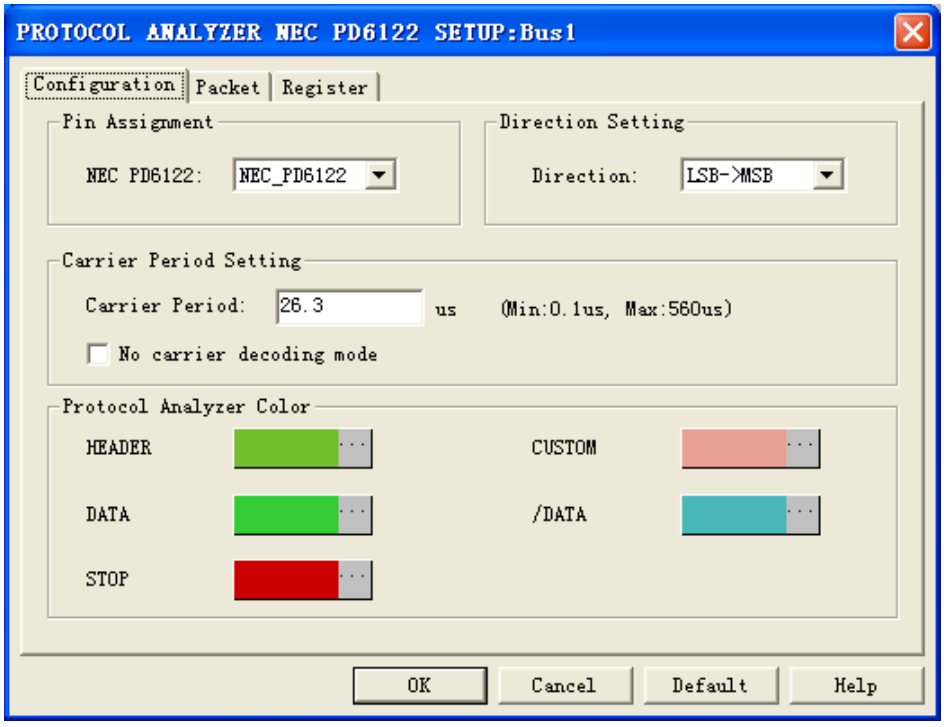

Figure 11: NEC PD6122 Decoding Module

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Philips RC-5

RC5 Infrared Remote Control Format, developed by Philips, is a kind of infrared remote control signal protocol. Although Philips has developed a more comprehensive RC6 Standard, most electronic products of Philips still utilize the RC5 Infrared Remote Control Format at present, and it can switch with the NEC Infrared Remote Control Format. Philips RC5 Remote Control Signal utilizes the 36KHz carrier. A bit information, which is transmitted each time, occupies 64 carrier periods (about 1.778MS). The time transmitted by infrared and the idle time occupies half of the carrier period (889US) respectively. That is to say, the time transmitted by the infrared signal is 32 carrier periods, and the idle time is also 32 carrier periods. If the transmission time is previous to the idle time, it indicates that the transmitted value is “0”; if the idle time is previous to the transmission time, it indicates that the transmitted value is “1”. In the Receiving Port, it adopts the Manchester Encoding.

Figure 12 shows the Philips RC-5 Packet Format. The RX channel is the Receiving Port of the RC-5, and the TX channel is the Transmitting Port of the RC-5.

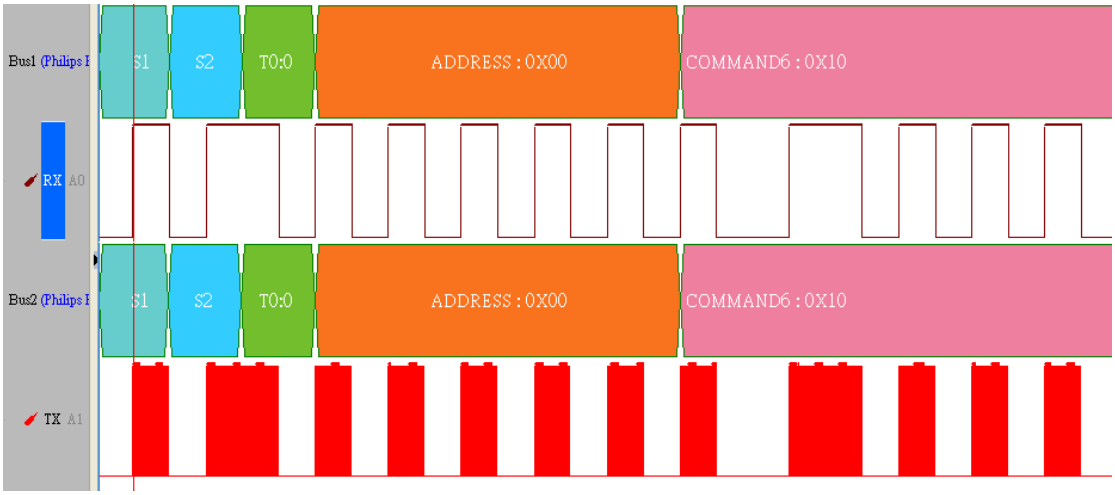

Figure 12: Philips RC-5 Packet Format

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When the Philips RC-5 Decoding Module of Zeroplus Logic Analyzer is used, the waveform of the signal can be decoded through the module, and the Baud Rate of the current signal can be detected through the automatic Baud Rate setting function, which can improve the working efficiency.

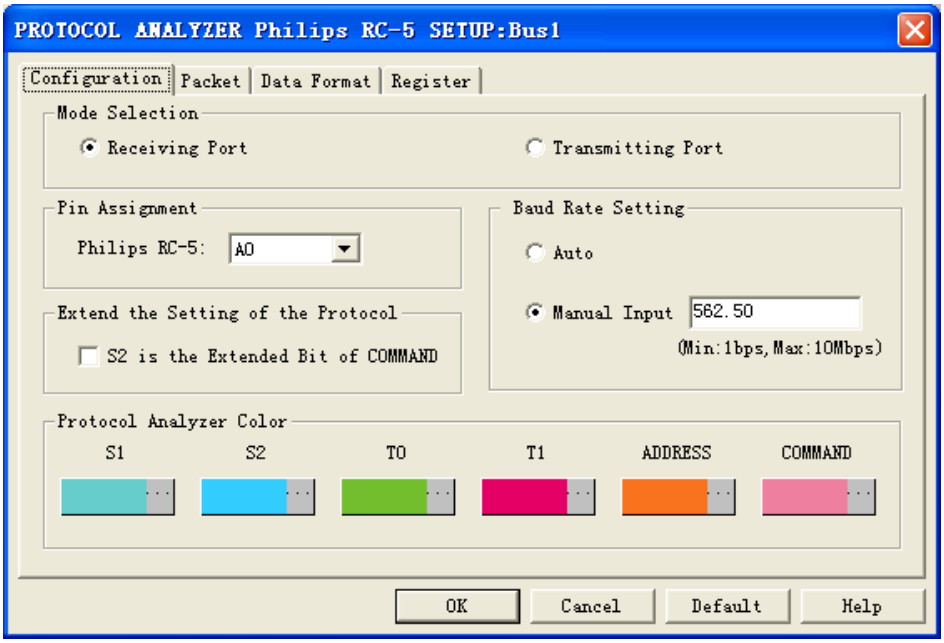

Figure 13: Philips RC-5 Decoding Module

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Philips RC-6

RC6 Infrared Remote Control Format, developed by Philips, is a new infrared remote control signal protocol. And it is similar to RC5 in the structure. Philips RC6 Remote Control Signal utilizes 36KHz carrier. A bit information, which is transmitted each time, occupies 32 carrier periods (about 889US). The time transmitted by infrared and the idle time occupies half of the carrier period (444US) respectively. That is to say, the time transmitted by the infrared signal is 16 carrier periods, and the idle time is also 16 carrier periods. If the transmission time is previous to the idle time, it indicates that the transmitted value is “1”; if the idle time is previous to the transmission time, it indicates that the transmitted value is “0”. In the Receiving Port, it adopts the Manchester Encoding.

The Philips RC-6 Decoding Module of Zeroplus Logic Analyzer also supplies the function of detecting Baud Rate automatically. When users analyze the signals, it is unnecessary to calculate the value by hands. That is to say, when they decode the signal, the software can judge the Baud Rate automatically.

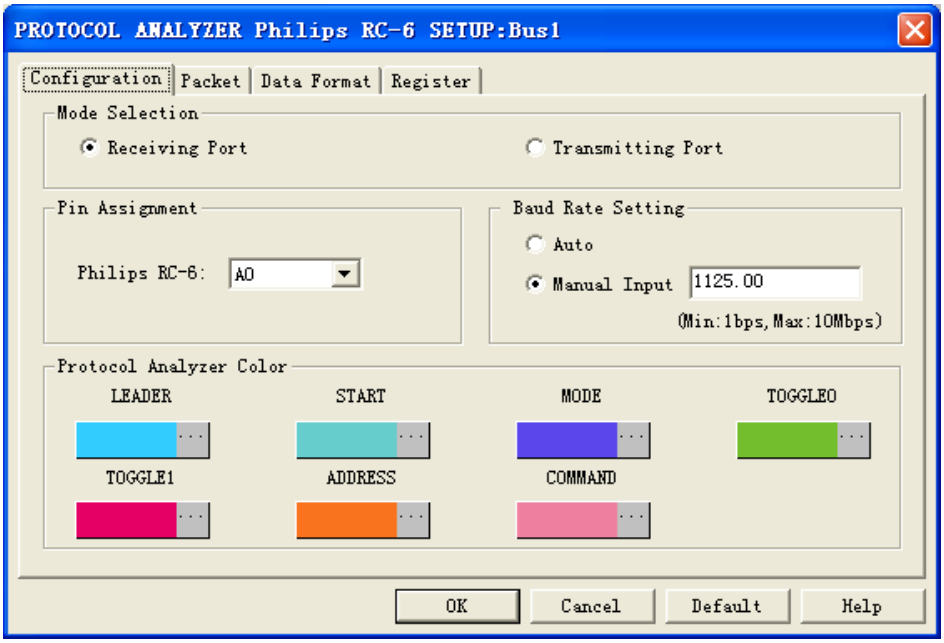

Figure 14: Philips RC-6 Decoding Module

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Conclusion

The infrared communication transmission can be influenced by the environment easily, but it is widely used for the remote controllers of the home appliance because of the feature of low cost; the wide use makes the quality of the home life improve greatly. Take the TV for example. When the TV did not have a remote controller early, users must go to the TV to turn on/off the TV, as well as switch the channel or adjust the volume. However, because of the application of the infrared, it is unnecessary to walk up to the TV to switch the channel, users can switch the desired channel by random on the sofa directly. Zeroplus Technology provides the customizable Bus Service, even if the infrared communication specification is developed by the manufacturer, such as NEC and Philips. And Zeroplus Technology can also design the decoding module for the clients. Zeroplus Technology Logic Analyzer has released more than 50 kinds of Protocol Analyzers. When engineers analyze the signal of the Protocol Analyzer, they can use the automatic decoding function of the software to reduce the time of developing the project, and make the product on the market earlier. At the same time, when they analyze the different kinds of digital signals, it is unnecessary to manually decode the signal to be analyzed. If you want to learn more information of Zeroplus Logic Analyzer, please visit the Zeroplus Technology Website, www.zeroplus.com.tw.

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