- Application Note for W5100 -

How to connect ADSL

Document History

Ver 1.0 (JAN 3, 2007)	First release

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This APP. Note shows a method of using W5100 in PPPoE(ADSL) conditions.

Below chart shows register related to using W5100 in PPPoE(ADSL) conditions.

S0_CR (Socket 0 Command Register) [R/W] [0x0401] [0x00]

About PPPoE command

Value	Symbol	Description
0x23	PCON	Start of ADSL connection (start PPPoE Discovery)
0x24	PDISCON	END of ADSL connection
0x25	PCR	Send REQ message in each Phase (About each phase in detail, Refer to the below.)
0x26	PCN	Send NAK message in each Phase
0x27	PCJ	Send REJECT message in each Phase

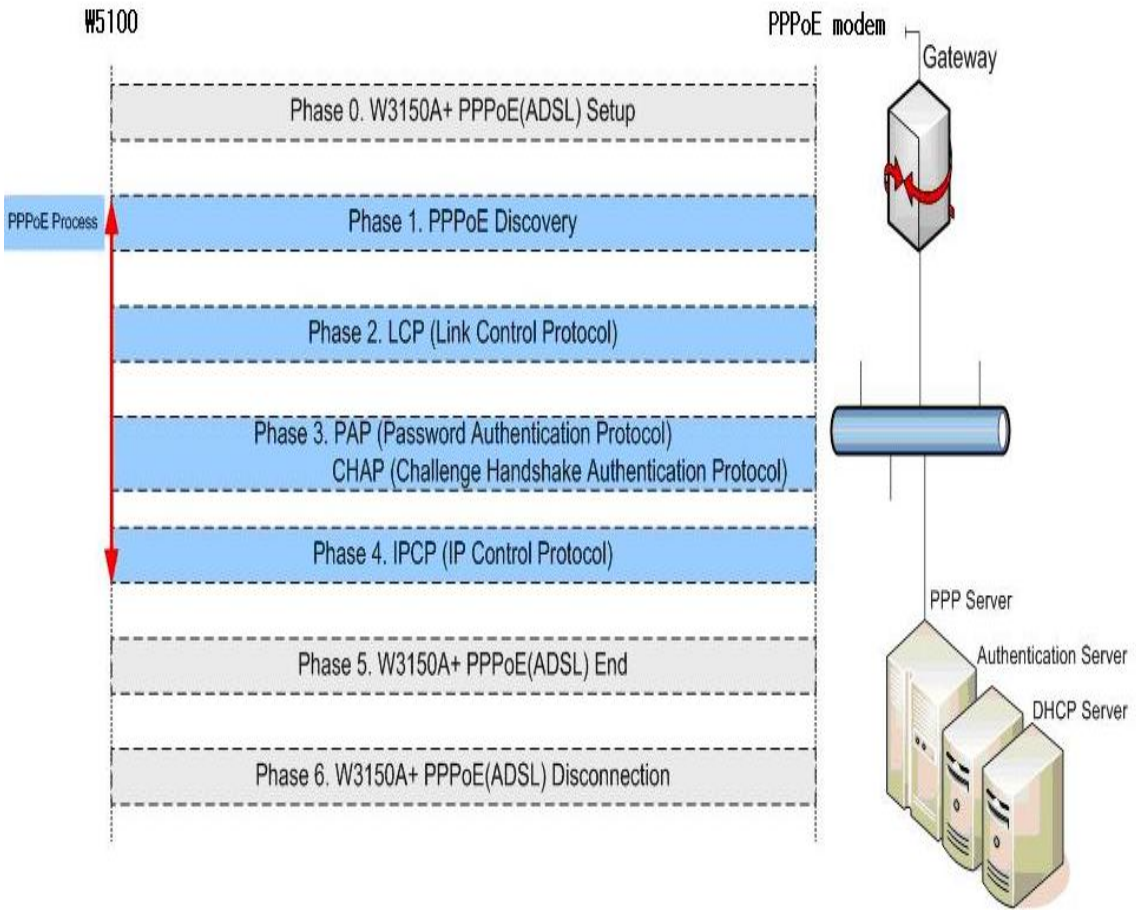
S0_IR (Socket n Interrupt Register) [R] [0x0402] [0x00]

About PPPoE Interrupt

7	6	5	4	3	2	1	0
PRECV	PFAIL	PNEXT	SEND_OK	TIMEOUT	RECV	DISCON	CON

Bit	Symbol	Description
7	PRECV	Indicate receiving no support option data
6	PFAIL	Indicate PAP Authentication Fail
5	PNEXT	Go next phase (About each phase in detail, Refer to the below.)
4	SEND_OK	Refer to the W5100 Datasheet.
3	TIMEOUT	
2	RECV	
1	DISCON	
0	CON	

Below figure shows the PPPoE(ADSL) connection process of W5100.



1. Phase 0

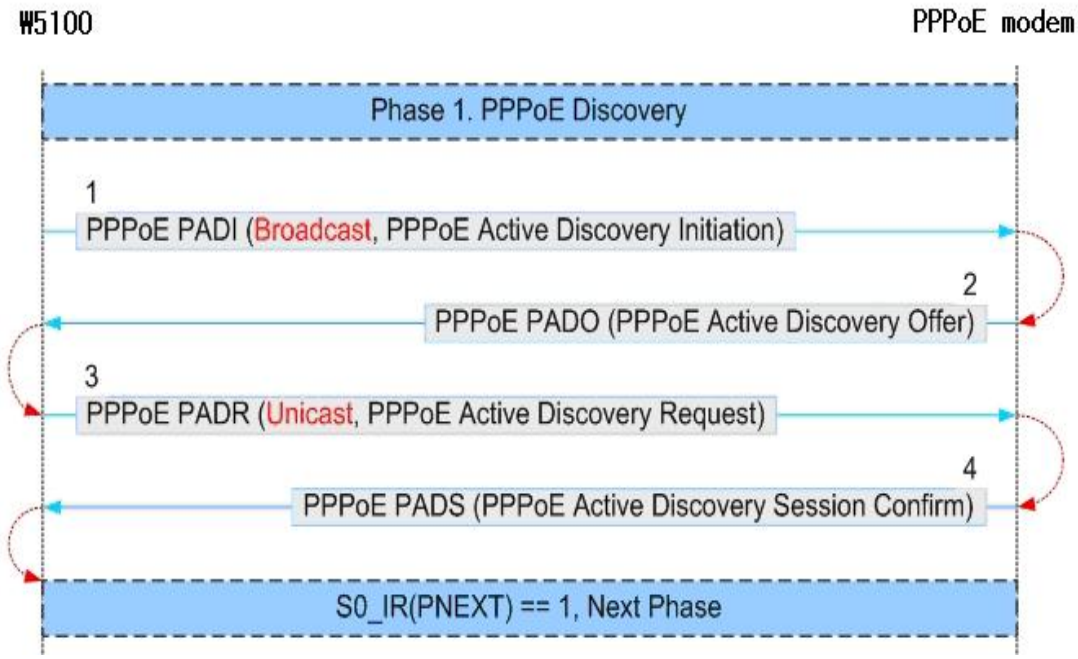
- W5100 PPPoE(ADSL) Setup

```
{
/* W5100 PPPoe(ADSL) initialization */
PHASE0 :
/* Set PPPoE bit in MR(Common Mode Register) */
    MR = 0x08;
/* Set the value of PTIMER and PMAGIC */
    PTIMER = 200; // set about 5 second
    PMAGIC = 0x01;
/* Set PPPoE mode on socket 0 mode register */
    S0_MR = 0x05;
/* Set OPEN command */
    S0_CR = OPEN;
}
```

2. Phase 1

- PPPoE(ADSL) Discovery Process

Below figure shows the PPPoE(ADSL) Discovery process.



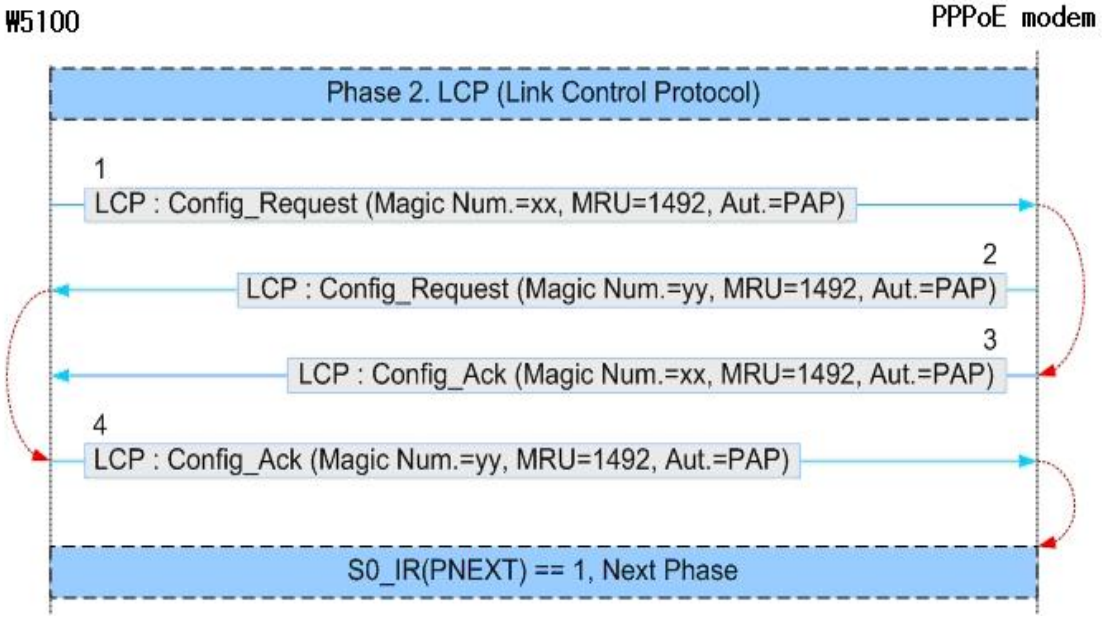
Through the step of PPPoE discovery, PPPoE server(ADSL Server) Ip Address and PPPoE session ID will be assigned.

```
{
/* Set Socket 0 Command Register to PCON for starting to PPPoE(ADSL) connection
    PPPoE(ADSL) discovery process starts */
    S0_CR = PCON;
    while
    {
        wait some time
        /* check whether PNEXT bit of socket 0 Interupt Register is set
            If PNEXT bit is set, PPPoE(ADSL) discovery process ends */
        if (S0_IR(PNEXT) == '1')
        {
            goto Next Phase (Phase2);
        }
        if (overtime) goto PHASE0;
    }
}
```

3. Phase 2

- PPPoE(ADSL) LCP(Link Control Process) Process

Below figure shows the LCP process.



By using LCP(Link Control Protocol), the information of authentication protocol type and MRU is negotiated. W5100 supports options of Maximum Receive Unit(0x01), Authentication Protocol (0x03), and Magic-number(0x05).

Below chart shows type values supported by W5100.

W3150A+ Support Type

Type	Name	Data
0x01	Maximum_Receive_Unit(MRU)	2 Bytes
0x03	Authentication_Protocol	PAP(0xC023), CHAP(0xC223)
0x05	Magic_Number	4 Bytes

```
{
    /* prepare option field of LCP
       Type, Length and option values are comprised in LCP configuration option field
       Type(0x05, Magic number), Length(0x06, 6bytes), Magic number(4bytes) */
    option_array = {0x05, 0x06, PMAGIC, PMAGIC, PMAGIC, PMAGIC};
    copy option_array to socket 0 TX memory;
    /* for copying, refer to TCP sending process in 5.Functional description of datasheet.*/
    /* send LCP Config_REQ message */
    S0_CR = PCR;
```

```
while
{
    wait some time
    /* check PRECV bit of S0_IR is set */
    if (S0_IR(PRECV) == '1')
    {
        Get the option_array from RX memory of socket 0;
        /* for getting the data, refer to TCP receiving process in 5.Functional description
           of datasheet */
        Parsing option_array and save reject option to reject_option_array
```

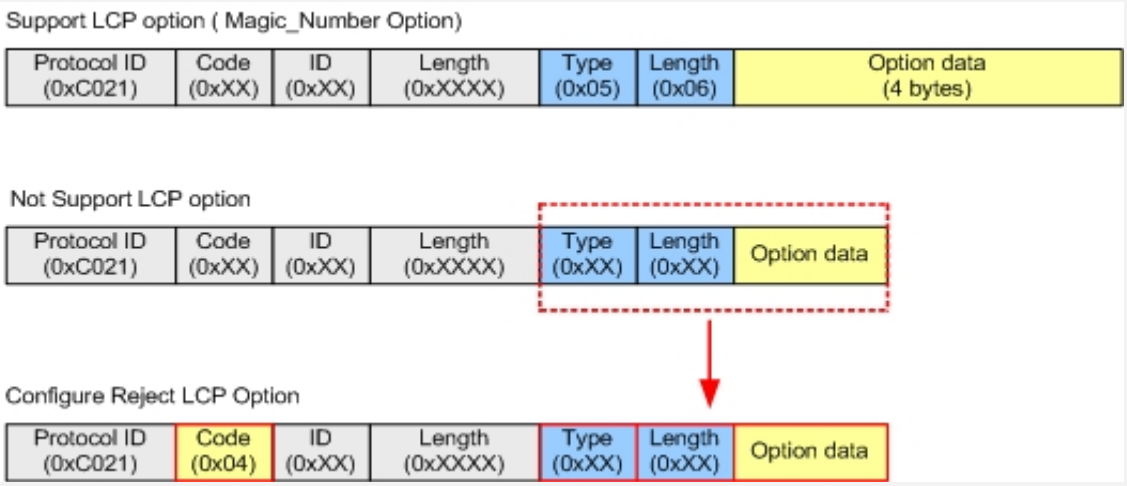


Figure 1. Configure Reject LCP Option

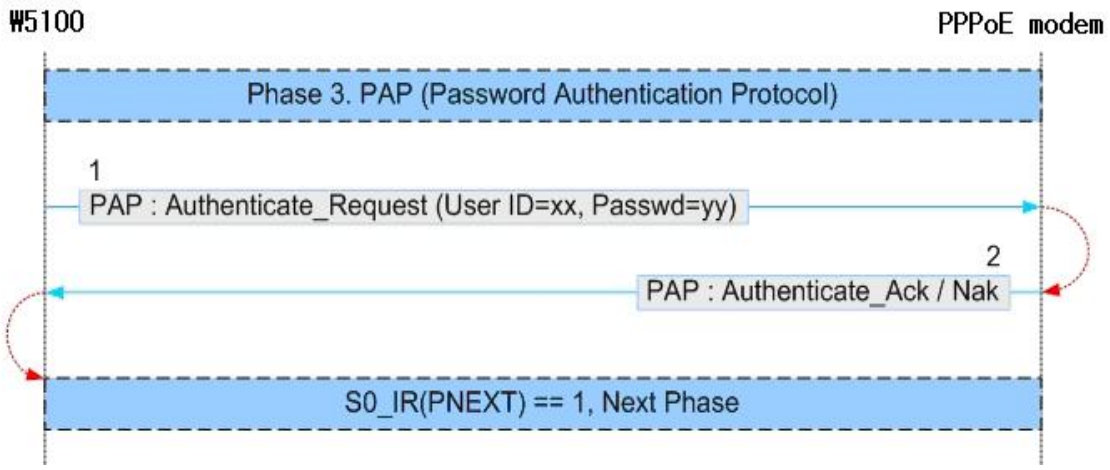
```
    {
        Skip 6 bytes in option_array; // ppp header 6 bytes
        /* each option field consist of [ kind(1) | len(1) | value(n) ] */
        Parsing all option fields as below
        {
            while (exist option field)
            {
                /* check support option kind */
                if (option(kind) != {0x01, 0x03, 0x05})
                save the option fields to reject_option_array;
            }
        }
    }
    Copy reject_option_array to socket 0 TX memory;
```

```
            /* send LCP Config_REJ message */
            S0_CR = PCJ;
        }
        /* check PNEXT bit of S0_IR is set */
        if (S0_IR(PNEXT) == '1') goto PHASE3;
        if (overtime) goto PHASE0;
    }
}
```

4. Phase 3

4.1 PAP(Password Authentication Protocol) Process

Below figure shows the PAP process.



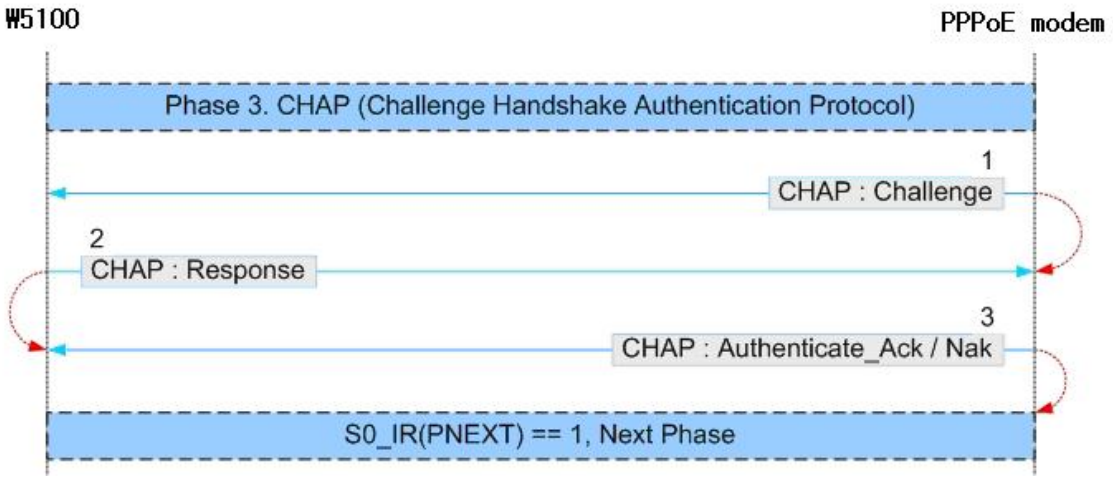
Now, perform authentication process with ID and Password by using Authentication Protocol acquired by Phase 2. In this case, authentication protocol is PAP(Password Authentication Protocol). In this document, the process is described with PAP generally used in ADSL.

```
{
    /* prepare option field of PAP Auth_REQ */
    /* [ IDlen(1) | ID(IDlen) | PWDlen(1) | PWD(PWDlen) ] */
    Save { IDlen(1),ID(IDlen),PWDlen(1),PWD(PWDlen) } to option_array
    copy option_array to TX memory of socket 0;
    /* send PAP Auth_REQ */
    S0_CR = PCR;
    while
    {
        wait some time
```

```
        /* check PFAIL bit of S0_IR is set */
        if (S0_IR(PFAIL) == '1')
        {
            Re-check ID, Password
            goto PHASE0;
        }
        /* check PNEXT bit of S0_IR is set */
        if (S0_IR(PNEXT) == '1') goto IPCP;
        if (overtime) goto PHASE0;
    }
}
```

4.2 CHAP(Challenge Handshake Authentication Protocol) Process

Below figure shows the PAP process.



Now, perform authentication process with ID and Password by using Authentication Protocol acquired by Phase 2. In this case, authentication protocol is CHAP(Challenge Handshake Authentication Protocol). In this document, the process is described with PAP generally used in ADSL.

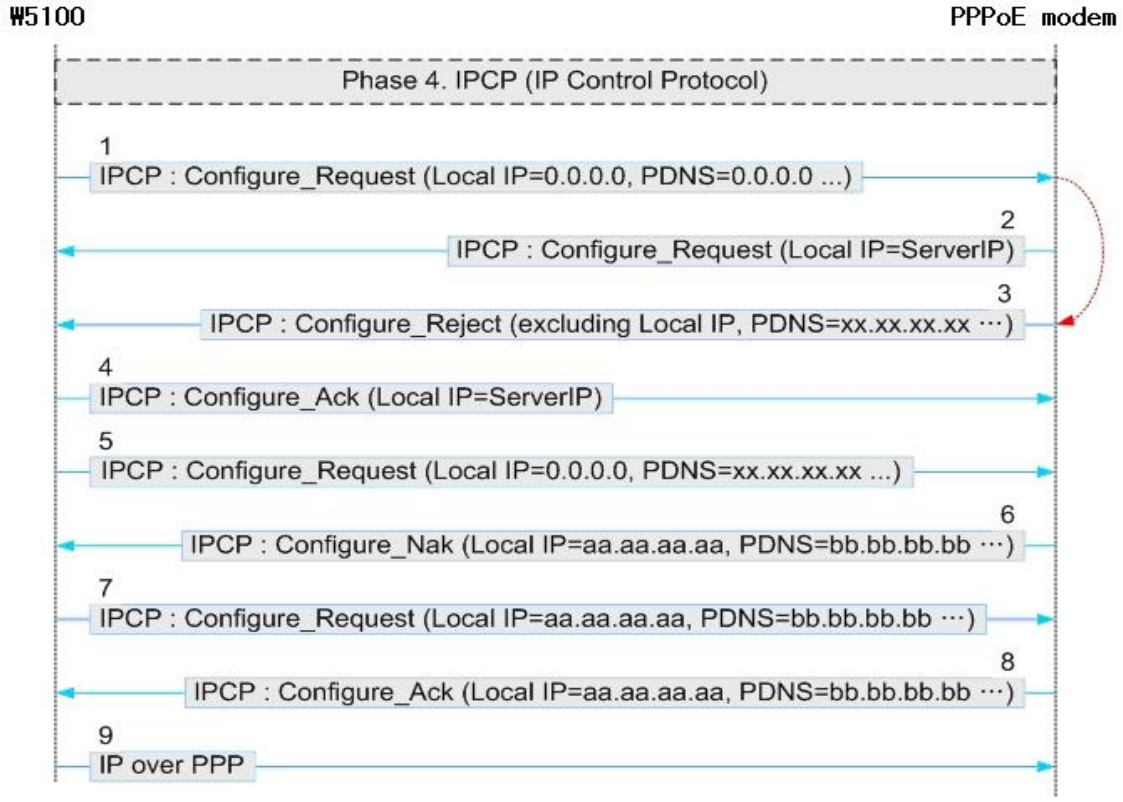
```
{
    /* for copying, refer to TCP receiving process in 5.Functional description of datasheet.*/
    /* receive PPP Challenge packet from PPP server */
    S0_CR = CRECV;

    /* prepare CHAP Response packet to PPP server */
    /* [ CHAP_ID(1) | Length(2) | HV(n) with MD5(Message Digest 5) ] */
```

```
    /* for copying, refer to TCP sendign process in 5.Functional description of datasheet.*/
    /* send PAP Auth_REQ */
    S0_CR = PCR;
    while
    {
        wait some time
        /* check PFAIL bit of S0_IR is set */
        if (S0_IR(PFAIL) == '1')
        {
            Re-check ID, Password
            goto PHASE0;
        }
        /* check PNEXT bit of S0_IR is set */
        if (S0_IR(PNEXT) == '1') goto IPCP;
        if (overtime) goto PHASE0;
    }
}
```

Phase 4> IPCP

Below figure shows the IPCP process.



In this phase, IP address is assigned by using IPCP. (If necessary, DNS and Gateway IP can be acquired, but only IP address is enough in ADSL)

```
{
    /* prepare option field of IPCP */
    option_array = {0x03, 0x06, 0x00, 0x00, 0x00, 0x00};
    copy option_array to socket 0 TX memory;
    /* send IPCP Config_REQ message */
    S0_CR = PCR;

    while
    {
        wait some time
        /* check PRECV bit of S0_IR is set */
        /* It is because IP address assigned to NAK message is sent from a server. */
        if (S0_IR(PRECV) == '1')
        {
            Get the received data of socket 0 RX memory and save to ip_option_array;
            {
                /* Parsing ip_option_array as below */
                Skip 6 bytes in ip_option_array; // ppp header 6 bytes
                {
                    /* Parsing all option fields as below */
                    /* each option field consist of [ kind(1) | len(1) | value(n) ] */
                    while (exist option field)
                    {
                        /* check ip option field */
                        if (option(kind) == 0x03)
                        {
                            save the option fields to option_array;
                            goto IPCP_END;
                        }
                    }
                }
            }
        }
        if (overtime) goto PHASE0;
```

```
    }
IPCP_END:
    Copy option_array to socket 0 TX memory;
    /* resend IPCP Config_REQ message */
    S0_CR = PCR;
    while
    {
        wait some time
        /* check PNEXT bit of S0_IR is set */
        if (S0_IR(PNEXT) == '1') goto PHASE5;
        if (overtime) goto PHASE0;
    }
}
```

Phase 5 > End

All the process for ADSL connection is finished. Close the 0th socket and use it.

```
{
    /* set CLOSE command */
    S0_CR = CLOSE;
}
```

Phase 6 > ADSL Disconnection

```
{
    /* Set PPPoE bit in MR(Mode Register). */
    MR = 0x08;
    /* Set PPPoE mode on socket 0 mode register */
    S0_MR = 0x05;
    /* set the ADSL server information */
    S0_DHAR = PPPoE_Server ;
    S0_DPORT = PPPoE_Session_ID;
    /* Set OPEN command */
    S0_CR = OPEN;
    /* Set PDISCON command for starting to disconnect to ADSL server */
    S0_CR = PDISCON;
    /* set CLOSE command */
```

```
    S0_CR = CLOSE;
}
```