TNETC400E Cable Modem

User's Guide

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Chapter 1

Overview

This chapter introduces the TNETC400E cable modem, its connections, external indicators, and the available kits including their contents.

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1.1 Introduction

The Texas Instruments (TI™) TNETC400E cable modem (CM) is a Data Over Cable Service interface Specification (DOCSIS) reference design. It combines TI's complete CM silicon and software solution with Toshiba's integrated tuner and Motorola's embedded PowerPC.

The single-board TNETC400E utilizes TI's MAC + PHY device, the TNETC4040 and the DOCSIS device driver software.

The TNETC400E is capable of supporting DOCSIS 1.1. it supports Quality of Service (QoS) using multiple service IDs (SIDs) and a flexible upstream queue design.

1.2 Kit Contents

The cable modem TNETC400E is available in the following three kits:

Kit 1: TNETC400E-CM — A cable modem kit. This kit includes:

- ❏ A TNETC400E cable modem
- ❏ A power supply with a DC jack connector
- ❏ A serial cable with 9 pin connectors
- ❏ An RS–232 adapter
- ❏ An Ethernet cable
- ❏ This user's guide

Kit 2: TNETC400E-EK – An evaluation kit that includes all of the items in kit 1 and an additional:

- ❏ CD-ROM TNETC400E-EK, which contains software object files, API, and documentation.

Kit 3: TNETC400E-RDK – A reference design kit that includes all of the items in kits 1 and an additional:

- ❏ CD-ROM TNETC400E-RDK, which contains all software code and source files, all hardware source and manufacture files, and comprehensive documentation.

1.3 Connections and External Indicators

This section reviews the front, rear, and interior views of the TNETC400E and its interfaces.

1.3.1 Front View

There are six LEDs on the TNETC400E's front panel. The LEDs are as follows:

1) POWER — Indicates that the modem is turned on, and that the boot–code is running.

2) STATUS — Indicates that the modem has found a valid channel, registered to the CMTS and is in operation. The STATUS LED blinks when the modem is not in synchronization and it is scanning for the downstream channels.

3) CBL–Rx — This LED is on when data packets are being received through the cable interface.

4) CBL–Tx — This LED is on when data packets are being transmitted through the cable interface.

5) LAN–Rx — This LED is on when data is being received through the Ethernet interface.

6) LAN–Tx – This LED is on when data is being transmitted through the Ethernet interface.

Figure 1–1. Photograph of TNETC400E Front View

1.3.2 Rear View

There are three connectors and one switch on the TNETC400E rear panel. They are as follows:

1) A female connector for the RF coaxial cable

2) A female connector for the DC power input. The inner pin is +5 V and the outer ring is the ground

3) A power switch

4) A female RJ-45 connector for the LAN Ethernet interface

Figure 1–2. Photograph of TNETC400E Back View

Looking at the rear of the TNETC400E with its rear panel removed in Figure 1–3, an empty space is shown between the Ethernet connector and the power switch. This space is reserved for the USB interface. To the right of the Ethernet connector there is a small 4-pin connector J6, which is for the serial interface to allow console monitoring. According to DOCSIS standard, the modem rear panel covers the serial interface (J6).

Figure 1–3. Photograph of the TNETC400E Back View Without the Panel

1.3.3 Interior View

The TNETC400E PCB is a 6-layer PCB. Connector J4 is an MPEG output connection. Connector P5 is a JTAG port, and connector P4 is a debug port for ICE use.

The TNETC400E is designed to be equipped with the highest possible amount of features, which is why the memory size is relatively large. There are two 4Mx16 SDRAMs configured as 32-bit width SDRAM for the CPU, two 2Mx16 FLASHs for the boot program and parameters, two 128Kx8 SRAMs configured as 16-bit width SRAMs for the TNETC4040. The same PCB is used in the TNETC400EV –a VoIP (VoCable Modem). In the TNETC400EV, a VoIP piggyback is connected to connector P6.

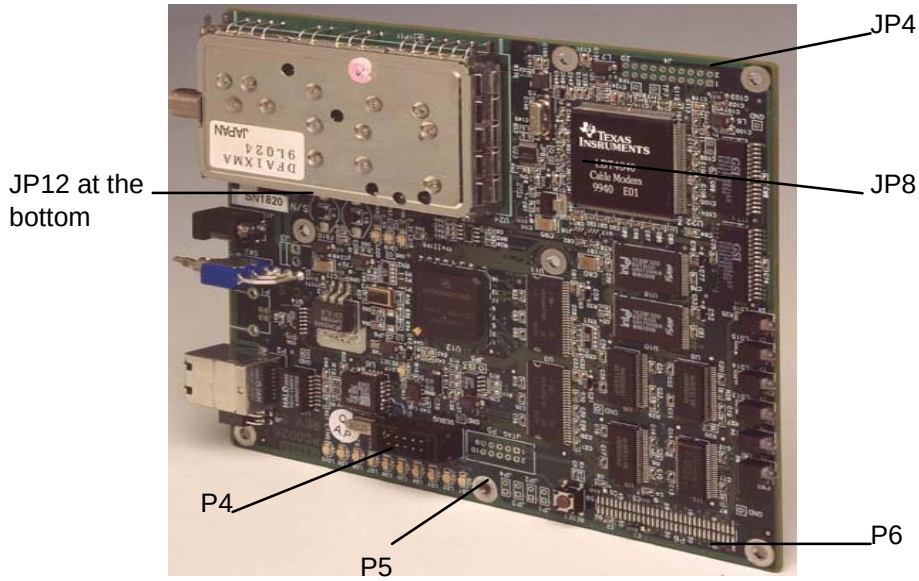

Figure 1–4. Photograph of the TNET400E Interior View

The TNETC400E reserves several jumpers for debug and configuration. In the released product, only JP8 and JP12 are shorted. JP8 is used to enable the power-down feature of the tuner. When there is no upstream transmission, the TNETC4040 disables the PGA inside the tuner automatically. JP12, on the solder side of the PCB, is a ground connection point to reduce noise.

Chapter 2

Installation Guide

This chapter instructs you on how to install the TNETC400E cable modem device.

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2.1 Hardware Setup

The TNETC400E is a full MCNS/DOCSIS cable modem. As such, it operates as part of an MCNS/DOCSIS system, which includes a CMTS connected to a server through an Ethernet connection.

The server must include the following: DHCP (dynamic host configure protocol), TOD (time of day) and TFTP (trivial file transfer protocol).

Figure 2–1 illustrates the connections needed to set up and work with the TNETC400E cable modem. The TNETC400E has a DC jack connector for a power supply input. It connects to the CPE via Ethernet 10baseT and to the CMTS via Coax/HFC cable. It also has a serial port connector (RS–232) for console operation with a terminal.

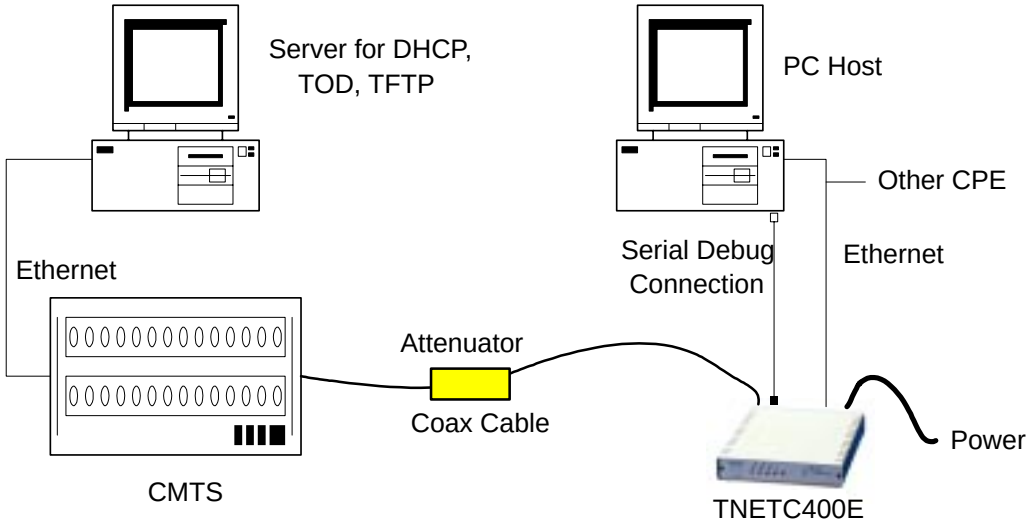

Figure 2–1. TNETC40E Setup

According to DOCSIS specification, the power level of the downstream signal must be between –15dBmV and +15dBmV. In lab setups, usually the coax cable is short and has no attenuation, which can yields the modem to saturation. Therefore, an attenuator is likely used to prevent the modem receiver from going into saturation.

The DHCP server must be configured to allocate an IP address (in the CMTS net segment), an IP net mask (like 255.255.255.0), an IP gateway (usually the CMTS IP if it is a router), a TOD server IP address (the Server IP), a TFTP server IP address (the server IP as well) and a boot file name (used as a configuration file to any client).

The TFTP server must be configured to transfer from the directory of the configuration file. Also ensure that the configuration file is copied to this location. A valid configuration file can be found in the \bin\ library, which is on the RDK CD-ROM.

The host PC is optional. It can be used as follows:

1) serial terminal emulator for control and monitoring

2) pSOS development environment

3) TFTP server for software download

According to the host PC tasks, it may or may not be connected to the modem side Ethernet and/or to the serial connection. Figure 2–2 shows the serial connection of the TNETC400E. Ensure that you have the correct direction and that all four pins are in the connector. On the host PC, you can use a hyper terminal to communicate with TNETC400E. The recommended setting for the hyper terminal is a baud rate of 9600 bps, no parity, 8 data bits, 1 stop bit, and no flow control.

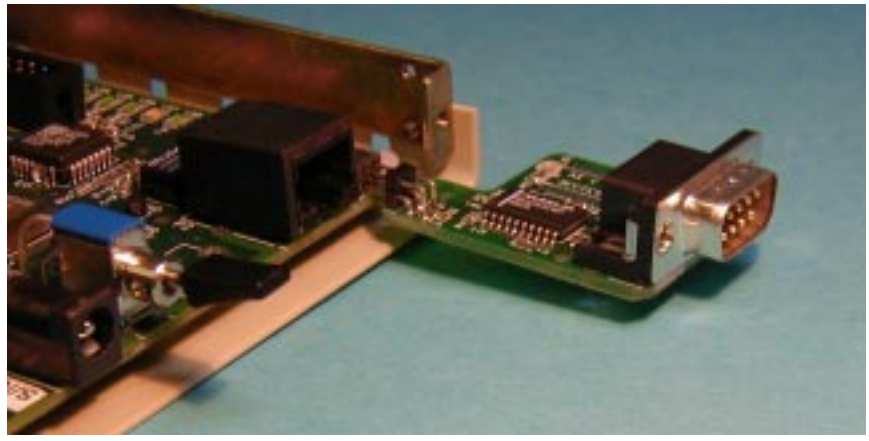

Figure 2–2. Serial Interface Connection

2.2 Configuration

The modem is case sensitive for the command typed.

The modem has two sectors on its flash memory. This enables the user to store two different image files and to select from which image file the modem will run.

On power up, the modem enables the user to get into a boot-parameter menu. During the power up the modem displays the following screen:

```
LBT400E – TI–CBC MCNS Cable Modem Board
------------------------------------------------------------
  IP address on LAN is 10.0.5.101
  LAN interface’s subnet mask is 255.255.255.0
  Serial channels will use a baud rate of 9600
  Ethernet hardware address is 0:50:F1:10:20:21
------------------------------------------------------------
```

After the preceding screen is displayed, it pauses for a configurable time (see CPU delay before startup on the following), typing any key during that pause time causes the following message to be displayed:

```
(M)odify boot parameters or (C)ontinue? [C]
```

Typing C or pressing the enter key causes the modem to continue the startup process as if no typing had occurred. Typing M and pressing the enter key places the modem into the boot-parameters menu and prompts the following screen:

```
(M)odify boot parameters or (C)ontinue? [C] m
For each of the following questions, you can press <Return> to
select the value shown in braces, or you can enter a new val-
ue.
This board’s LAN IP address(0.0.0.0 = RARP)? [10.0.5.101]
Subnet mask for LAN (0 for none)? [255.255.255.0]
Baud rate for serial channels [9600]
Do you want to change the Ethernet address? [N]
How should the board boot?
  1. Run the Cable Modem Application
  2. pSOS debugger via a network connection
Which one do you want? [1]
Do you want change BOOT / MCNS Cable Modem parameters?  [N]
How long (in seconds) should CPU delay before starting up? [1]
------------------------------------------------------------
  IP address on LAN is 10.0.5.61
  LAN interface’s subnet mask is 255.255.255.0
  Serial channels will use a baud rate of 9600
  Ethernet hardware address is 0:50:F1:10:20:21
------------------------------------------------------------
(M)odify boot parameters or (C)ontinue? [C]
```

This board's LAN IP address(0.0.0.0 = RARP)? [10.0.5.101]

Subnet mask for LAN (0 for none)? [255.255.255.0] display

This is where you can modify the LAN IP address and the subnet mask. The LAN IP address that you input should be reserved in the DHCP server. Otherwise, it may conflict with other devices on the Ethernet. The subnet mask depends on your environment.

Baud rate for serial channels [9600] display

Baud rate should be set to the same value as in the hyper terminal of the host PC. Ensure both sides have the same baud rate setting.

Do you want to change the Ethernet address? [N] display

The Ethernet address refers to the Ethernet MAC address. If you type "y", the program prompts you to input your setting.

How should the board boot? display

Selecting Between Cable Modem Application and pSOS Debugger [1]

The board can run the cable modem application, but it can also serve as a development platform for pSOS applications. If you type '2', the board waits for pSOS debugger (pROBE+) to communicate with it through the LAN. A debugger using pROBE+ is part of the pSOS development platform, and it is not supplied.

When you type '1', the board runs the application, which is stored in its flash.

Do you want to change BOOT/MCNS cable-modem parameters? [N] display

Typing N leads the modem to the next command. Typing Y leads the modem to the boot-parameter submenu. See details in section 2.2.1, Changing Boot Parameters.

Setting how long (in seconds) the CPU delays before startup display

The user can set the pause time that the modem provides by typing any key for getting into the boot-modification menu. The time is in seconds. If no key is typed during this pause time, the modem continues the reset process. When a key is pressed the following line appears on the screen: `(M)odify boot parameters or (C)ontinue? [C]`

2.2.1 Changing the Boot Parameters

Do you want to change BOOT / MCNS cable modem parameters? [N] y display

Typing Y produces the following list of applicable commands that enables the modem to change the boot parameters (e.g., which software image to run). To skip this menu, type N or press enter.

```
Do you want change BOOT / MCNS Cable Modem parameters?  [N] y Updating
parameter storage. This may take a while...Done

TI CBC MCNS Cable Modem Application (pSOS 250)
------------------------------------------------------------
Available commands:
 Help                      – List available commands
 dir                       – List available modem software versions
 erase <sec#>              – Erase sector <sec#> from Flash
 dl <sec#>,<srvIP>,<name> – Download file <name> from <srvIP> to sector <sec#>
 setdef <sec#>             – Set <sec#> as default modem software
 reboot                    – Reboot the modem
 mac                       – Show Cable Modem MAC address
 setmac <X–X–X–X–X–X>     – Set Cable Modem MAC address
 ser                       – Show Cable Modem Serial Number
 setser <serial>           – Set Cable Modem Serial Number
LBT400>
```

Updating parameter storage. This may take a while...Done display

The LAN parameters are stored to flash.

dir command

Lists the contents of each flash sector. The information includes sector number, image file name and CRC check. The little arrow to the left of the (–>Sec#) indicates the default image to load on startup.

```
LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
–> Sec#1 lbt400e_ver2.10_Feb.img                    CRC OK
   Sec#2  TestApp400E_apr06.img                     CRC OK
LBT400>
```

erase <sec#> command

Erases software image located on sector number <sec#> of the Flash and clear its information from non–volatile memory. **Caution: This command is destructive.**

```
LBT400> erase 1
Are you sure you want to erase sector #1 ? [y/n]y
Erasing sector 1 ... Done.

LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
   Sec#1  <Empty>
–> Sec#2  TestApp400E_apr06.img                    CRC OK

LBT400>
```

dl <sec#>, <srvIP>, <name> command

Downloads software image file <name> from TFTP server with IP address <srvIP> to flash sector number <sec#>. The download uses a TFTP protocol to download the software image file. The file must be an S–records hex text file. The target sector must be empty to allow download operation. This can be done with the **erase** command.

```
LBT400> dl 1,10.0.5.60,lbt400e_ver2.13_mar28.img
Downloading <lbt400e_ver2.13_mar28.img> from TFTP server
<10.0.5.60> to Flash sector# 1
Starting the TFTP download
.....................................................
Programming the FLASH (image size=835468 [0xCBF8C])...
File download and FLASH programming successfully completed

LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
   Sec#1  lbt400e_ver2.13_mar28.img                CRC OK
–> Sec#2  TestApp400E_apr06.img                    CRC OK

LBT400>
```

An S–records hex text file can be generated by the pSOS compiler and utilities. For example:

```
psosmake
ddump –Rv rom.elf –o my_new_version.hex
```

setdef <sec#> command

Sets the default software image to boot from to that in flash sector number <sec#>.

```
LBT400> dir

Directory of LBT400 Flash (Checking CRC, Please wait ...)
   Sec#1  lbt400e_ver2.13_mar28.img                 CRC OK
–> Sec#2  TestApp400E_apr06.img                     CRC OK

LBT400> setdef 1
Setting default sector to 1

LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
–> Sec#1  lbt400e_ver2.13_mar28.img                  CRC OK
   Sec#2  TestApp400E_apr06.img                      CRC OK

LBT400>
```

mac command

Shows the cable modem MAC address. This address is stored in flash memory and can be updated by the **setmac** command now or by the same command in the console of the working mode. The cable modem MAC address must be unique to each modem in the world like any Ethernet MAC address. The application uses this address when accessing the CMTS.

```
LBT400> mac
Cable Modem MAC address is 00–50–F1–12–20–21
LBT400>
```

setmac <X–X–X–X–X–X> command

Sets the cable modem MAC address to a new value. The value must be entered in a six two–digit hexadecimal numbers separated by '–'.

```
LBT400> setmac 00–50–F1–12–00–01
Set Cable Modem MAC address is 00–50–F1–12–00–01
LBT400>
```

reboot command

The reboot command reboots the board using the updated parameters and boot files. Powering Off-On or pushing the reset push button generates the same process as reboot.

```
LBT400D – Libit MCNS Cable Modem Board
----------------------------------------------------------------
  IP address on LAN is 10.0.5.61
  LAN interface's subnet mask is 255.255.255.0
  Serial channels will use a baud rate of 9600
  Ethernet hardware address is 0:50:F1:10:20:21
----------------------------------------------------------------
                            ****
                            ****
                            ******o***
                        ********_///_****
                         ******/_//_/*****
                          ** ***(__/*****
                            *********
                             ****
                              ***
              **********************************
              **      Texas Instruments       ***
              **   DOCSIS based Cable Modem   ***
              **********************************
     Version 2.13 – Creation Date/Time:  Mar 28 2000 /
20:43:18
Press <CTRL+d> to enter Console mode
Trying to synchronize ...
Scanning frequency 93000000Hz
```

Chapter 3

Working Mode

This chapter discusses the cable modem board and defines the various screen displays.

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3.1 Working Mode

Ensure that the modem is not booting from a test image file. Boot from sector # 1 (sec#1) in the following example. See the test application section for full details of the test image file.

```
LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
–> Sec#1  lbt400e_ver2.13_mar28.img                CRC OK
   Sec#2  TestApp400E_apr06.img                    CRC OK
LBT400>
```

After reboot, the cable modem starts scanning for an active downstream channel.

```
LBT400E – TI–CBC MCNS Cable Modem Board
------------------------------------------------------------
  IP address on LAN is 10.0.5.101
  LAN interface's subnet mask is 255.255.255.0
  Serial channels will use a baud rate of 9600
  Ethernet hardware address is 0:50:F1:10:20:21
------------------------------------------------------------
                            ****
                            ****
                            ******o***
                        ********_///_****
                         ******/_//_/*****
                          ** ***(__/*****
                              *********
                               ****
              **********************************
              **      Texas Instruments       ***
              **   DOCSIS based Cable Modem   ***
              **********************************
Version 2.13 – Creation Date/Time:  Mar 23 2000 / 13:58:45

Press <CTRL+d> to enter Console mode
Trying to synchronize ...
Scanning frequency 93000000Hz
Scanning frequency 99000000Hz
Scanning frequency 105000000Hz
.....
```

The modem remembers the last five downstream frequencies on which it previously had a successful lock and it looks for an active downstream on these five frequencies first. If the modem does not find an active channel on one of these five frequencies, it continues to repeatedly scan the entire spectrum on a cyclic manner. If you wish to erase the modem frequency cache to forget these five frequencies, use “scanreset” or “default” commands available from console mode described in this manual.

When the modem is locked on to an active downstream channel, 333MHz for the following example, it acquires an IP address from the DHCP server and TOD information, and registers to CMTS. Then, the cable modem is synchronized and it displays “MODEM IS ACTIVE”.

```
.....................................................................
Scanning frequency 321000000Hz
Scanning frequency 327000000Hz
Scanning frequency 333000000Hz
Downstream Locked – Collecting Upstream Information
Starting Ranging On Channel 9
SYNCHRONIZED – 105000000 Hz , ucd 9
Trying to register through CMTS...
DHCP – parameters acquired
Time of day – retrieved
Registration file – downloaded
REGISTRATION COMPLETE – MODEM IS ACTIVE
```

“Trying to synchronize...” display

This display means that the modem is scanning for downstream and upstream channels.

“SYNCHRONIZED – 333000000 Hz , ucd 9” display

This display means that the modem is locked on the downstream channel in 333MHz and range successfully on UCD 9.

“Trying to register through CMTS...” display

This display means that an IP connection has been established and that the modem is trying to acquire its working parameters and register the CMTS.

“DHCP – parameters acquired” display

This display means that the DHCP process has ended successfully and that the modem has configured itself.

“Time of day – retrieved” display

This means that the TOD process has ended successfully and that the modem clock is set to the correct time.

“Registration file – downloaded” display

This display means that the TFTP process has ended successfully and the configuration file has been downloaded to the modem.

“REGISTRATION COMPLETE – MODEM IS ACTIVE” display

This display means that the modem has registered to the CMTS and has received a good registration response. The modem is in the operation mode and is forwarding data according to the configuration file.

Chapter 4

Console Mode

This chapter defines and illustrates the commands used in console mode.

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4.2 Console Mode Commands 4-3

4.1 Introduction

The console mode enables the user to change the modem settings, and access the various registers and memory. This section gives a detailed description of the commands used to perform these functions.

To get the modem into console mode, you must type “ctrl + d” at any time from working mode screen. The modem may still be scanning for frequencies (e.g., no CMTS) and is continuing to display the `Scanning frequency` messages. Ignore these messages and type blindly ctrl + d. If the messages are distracting you from initiating a command to the modem, you can halt the scanning process by typing blindly scanmode 0 (see the following example). To restart the scan, type scanmode 1 and tuner commands or reboot the modem. The scanmode and tuner commands are described later in this chapter.

The software package of the reference design kit enables the designer to add a password to control access to the console mode. However, this feature is not implemented in the image file of this modem.

```
Scanning frequency 175750000Hz
Scanning frequency 181750000Hz
Scanning frequency 187750000Hz

>>>
Cable Modem Console
Type 'help' for list of commands
CONSOLE> Scanning frequency 193750000Hz
Scanning frequency 199750000Hz
Scanning frequency 205750000Hz
Scanning frequency 211750000Hz
Scanning frequency 217750000Hz
sScanning frequency 223750000Hz
Scanning frequency 229750000Hz
cScanning frequency 235750000Hz
aScanning frequency 241750000Hz
nScanning frequency 247750000Hz
Scanning frequency 253750000Hz
mScanning frequency 259750000Hz
oScanning frequency 265750000Hz
deScanning frequency 271750000Hz
Scanning frequency 277750000Hz
0Scanning frequency 283750000Hz
Scan mode – OFF
CONSOLE>
```

4.2 Console Mode Commands

For ease of use in console mode, the modem recognizes a partial command (e.g., typing t is the same as tuner). In console mode, type help or h to list all available commands.

```
CONSOLE> help
Console Commands for this level:
 stat          – Display current CM state.
 macaddr       – Display Cable MAC address.
 setmac        – Set Cable MAC address.
 setcableip    – Sets the cable modem IP address.
 getcableip    – Print the cable modem IP address.
 cpes          – Display list of learned cpe's.
 addcpe        – Add new cpe to the learned cpe's.
 read          – Read from PHY register <reg>.
 write         – Write <data> to PHY register <reg>.
 macread       – Read from MAC register <reg>..
 macwrite      – Write <data> to MAC register <reg>.
 sread         – Read from SRAM <addr> through MAC.
 swrite        – Write <data> to SRAM <addr> through MAC.
 phystatus     – Display status of PHY.
 tuner         – Program the tuner to <freq>(Mhz) & Sync [US option].
 gain          – Control the upstream gain.
 syncparams    – Update Sync Parametes <K0,K1,Threshold>.
 invalidkey    – Invalidate RSA keys (reboot will regenerate).
 scanreset     – Reset scanning frequency cache.
 config        – Display configuration file.
 ucd           – Display current ucds.
 mapdata       – Transfer MAP messages also to the software (0 or 1).
 replevel      – Update [set|reset] Report level: repl [–|+]<level_id>.
 shipfilters   – Shows IP filters.
 shllcfilters  – Shows LLC filters.
 hwcounters    – Shows HW counters.
 scanmode      – Set Scan Mode (0 or 1).
 version       – Software Version.
 reboot        – 'reboot 0' will reboot the cable modem.
 upstat        – Upstream Status for SID n.
 default       – Change CM mode to 'default'.
 printdsdb     – Print HAL DS DB.
 help          – Display this message.
 quit          – Quit the console.
 showLAN       – Show collected LAN info.
 showcab       – Show collected Cable info.
CONSOLE>
```

Stat command

Displays the current status of the modem.

```
CONSOLE> stat
MODEM STATUS – OPERATIONAL
CONSOLE>
```

The modem can be in one of the following states:

Modem State	Definition
NOT_SYNC	Modem is not locked on a downstream channel
NOT_READY	While booting and after reset of the TNETC4040, while scanning for example
PHY_SYNC	The PHY is locked on a downstream channel
RANGING_COMPLETE	Initial ranging has been completed
PARM_ACQUIRED	DHCP parameters have been acquired
IP_COMPLETE	IP connectivity has been established
TOD_ESTABLISHED	Time of day has been established
SECURITY_ESTABLISHED	Baseline privacy keys have been exchanged
PARM_TRANSFER_COMPLETE	Configuration file has been loaded from the TFTP server
REGISTRATION_COMPLETE	Registration process is completed
OPERATIONAL	The modem is registered and forwarding data

macaddr command

Displays the cable interface MAC address.

Setmac command

Sets a new MAC address to the cable interface. The address should be in the format XX–XX–XX–XX–XX–XX (where XX is a two–digit hex number). The new MAC address is saved in the flash. The operation takes affect only after restarting the modem.

Setcableip command

Sets a new IP address to the cable interface. This IP overrides the IP assigned by the DHCP server. It is useful when the DHCP protocol is not active. The IP address should be in the format ddd.ddd.ddd.ddd where ddd is a three-digit hex number.

Getcableip command

Displays the IP address of the cable interface, as acquired by the DHCP process or assigned by the setcableip command.

cpes command

Displays the MAC address of the CPE learned by the modem. The CM forwards data to or from CPEs that appear in this list.

In addition, it displays the way the address was learned as follows:

1) Dynamic – through listening to the network traffic

2) Static – set by the user using the command addcpe or added by a command in the configuration file

The modem can be configured to learn any number of CPEs from 0 to 16. The default number of the CPE is 1 and this is changed in the configuration file.

addcpe command

Manually adds a new static MAC address to the table of a known CPE. Only the CPEs that appear in the table are enabled to forward data through the CM. To see the current list of CPEs, use the cpes command.

read command

Reads the value of one of the PHY registers. The register number can be in the range 0x0 – 0x7F. See the TNETC4040 datasheet for detailed information about the registers.

write command

Writes data to one of the PHY registers. The register number can be in the range 0x0 – 0x7F. See the TNETC4040 datasheet for detailed information about the registers.

Changing any of the TNETC4040 registers can interfere with the normal operation of the modem.

macread command

Reads the value of one of the MAC registers. The register number can be in the range 0x0–0xFFFF. Here, for convenience, we omit the higher bits of the absolute address (0xNNNN is equivalent to 0x7NNNN). See the TNETC4040 datasheet for detailed information about the registers.

macwrite command

Writes data to one of the MAC registers. The register number can be in the range 0x0–xFFFF. Here, for convenience, we omit the higher bits of the absolute address. See the TNETC4040 datasheet for detailed information about the registers.

Changing any of the TNET4040 registers can interfere with the normal operation of the modem.

sread command

Displays the content of the SRAM connected to the TNETC4040. The address is in the range 0–0x3FFFF. Ninety-six (96) bytes will be displayed. The SRAM contains the packets received in the downstream and transmitted in the upstream. Refer to the TNETC4040 datasheet for more information about the data in the SRAM.

swrite command

Writes a 16-bit value to a specific address in the SRAM connected to the TNETC4040. The address should be even and in the range 0–0x3FFFE.

Changing the SRAM content can interfere with the normal operation of the modem.

phystatus command

Displays the current status of the TNETC4040 QAM receiver. The following is an example:

```
CONSOLE> phystatus
Current PHY status:
Downstream Freq – 333.000 MHz
MSE – –35.385 dB
Timing Offset – –10.175 ppm
Carrier Offset – –61.346 Hz
AGC Gain – 161
Qam mode – 256 QAM
Interleave mode – I=128, J=1
CW Error Rate – 0.00e+00
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
```

tuner command

Forces the tuner to try to lock on a desired frequency. The modem resets its PHY parameters and tries to find a QAM signal on the frequency entered. Frequency is expressed in MHz and can include a decimal point (i.e., 507.25 MHz means 507,250,000Hz). In case the modem does not find a valid signal on the requested frequency, it continues the scanning process.

```
CONSOLE> t 507.25
CONSOLE> Trying to synchronize ...
Tuning to frequency 507250000Hz, (us 0 mode 1)
Downstream Locked – Collecting Upstream Information
Starting Ranging On Channel 9
SYNCHRONIZED – 507250000 Hz , ucd 9
Trying to register through CMTS...
DHCP – parameters acquired
Registration file – downloaded
REGISTRATION COMPLETE – MODEM IS ACTIVE
```

gain command

The gain command manually changes the upstream transmission gain. This command programs the upstream PGA to the specified gain. Gain should be in the range 0dB up to 63dB. In normal operation, the gain is changed automatically according to the data in the RNG–RSP message.

syncparams command

This command is reserved for debug use only. Do not use this command.

invalidkey command

Invalidates the RSA keys in the flash. This causes the regeneration of the RSA keys on reboot.

scanreset command

After reset, the modem scans the downstream frequencies for an active signal. The modem first tries the last five frequencies on which it has successfully locked before. The scanreset command clears this cache and the next time the modem starts the scanning from the lowest downstream frequency.

config command

Shows the configuration file. An example follows:

```
CONSOLE> config
Configuration File Parameters:
******************************
Network Access =  1
Class Of Service :
        Class ID =  1
        CoS Privacy Enable =  1
Baseline Privacy :
        Authorized Timeout = 180
        Re–Authorized Wait Timeout = 300
        Authorization Grace Time = 600
        Operational Wait Timeout = 180
        Re–key Wait Timeout = 180
        TEK Grace Time = 600
        Authorization Reject Wait Timeout = 600
CM MIC = 41 40 2d a8 b5 ad cb 49 49 66 e4 20 90 17  0 81
CMTS MIC = 3c 14 f3 b6 f1 9e a5 28 36 2e fd ce 86 7b 8f 68
CONSOLE>
```

ucd command

Displays the burst profiles parameters that are currently in use, as acquired from the UCD message. For example:

```
CONSOLE> ucd
Upstream ID: 9, Frequency: 14000000Hz, Symbol Rate: 160 KSym/Sec
IUC 1 – Preamble(O=  0,L=128) FEC(T= 0,K=  1) QPSK  Fixed Scr–ON  Dif–OFF
IUC 2 – Preamble(O=  0,L=128) FEC(T= 0,K=  1) QPSK  Fixed Scr–ON  Dif–OFF
IUC 3 – Preamble(O=  0,L=128) FEC(T= 5,K= 34) QPSK  Fixed Scr–ON  Dif–OFF
IUC 4 – Preamble(O=  0,L=128) FEC(T= 5,K= 34) QPSK  Fixed Scr–ON  Dif–OFF
IUC 5 – Preamble(O=  0,L=128) FEC(T= 0,K=  1) QPSK  Fixed Scr–ON  Dif–OFF
IUC 6 – Preamble(O=  0,L=128) FEC(T= 0,K=  1) QPSK  Fixed Scr–ON  Dif–OFF
CONSOLE>
```

mapdata command

This command is reserved for debug use only. Do not use this command.

replevel command

Changes the report level (status messages) of the modem. The modem can print status messages on many events. The user can control the amount of these messages by using the repl command. There are 26 different types of message classes. The following screen presents those that are implemented. It is possible to turn on (+level) and off (–level) each class. Class 27 turns on (+27) or off (–27) all the classes. This list of classes appears as a result of using repl 0:

```
CONSOLE> rep 0
Report levels ON:
 1 OS            16 CableNet
 2 TCB           17 Bridge
 3 Upstream      18 IP Apps.
 4 Hardware      19 Statistics
 5 Management    20 Main S.M.
 6 Mapping       21 Root
 7 Registration  22 CM Msgs.
 8 Sync          23 RSA
 9 BLP           24 SNMP
10 TSM           27 ALL
11 Downstream
12 Sniffer
13 CPU Util.
CONSOLE>
```

Please note:

1) This feature has no influence on the cable modem performance. See Appendix A for information about these messages.

2) On power on, all report levels are set to off by default.

3) It might happen that the modem continues to display although you already typed in the rep–27 command. The display will continue until the buffer is cleared.

shipfilters command

Displays a list of the currently active IP filters.

shllcfilters command

Displays a list of the currently active LLC filters.

hwcounters command

Shows TNETC4040 internal statistics counters.

scanmode command

When set to 0, it stops scanning downstream channels, and when set to 1, it enables the scanning. After typing scanmode 1, scan mode is enabled but the mode does not start scanning. To restart the scanning, you must force the modem to try to lock on a certain frequency by using the tuner command.

Version command

Displays the software and hardware versions of the cable modem as shown below:

```
CONSOLE> ver
Version: Software – 2.13
         Hardware – 0005 (4040)
CONSOLE>
```

reboot command

Soft reset of the CM by reboot 0.

upstat command

Displays the upstream state. You must specify an upstream channel number.

default command

As prompting messages, this command resets the frequency cache and cancels all report levels.

```
CONSOLE> default
Reset Frequency cache
No Report Levels
CONSOLE>
```

printdsdb command

Displays the downstream database.

```
CONSOLE> printdsdb
FreeCount: 1023; Seq: 4; BusyPtr: 704; FreePtr: 705
FreeDBCounter: 8896; AddDBCounter: 8897; 50YearsCounter: 0
BoundaryError: 0; NotBusyError: 0
CONSOLE>
```

help command

Displays this help message.

quit command

Quits the console. Press <ctrl+d> to reactivate the console.

showLAN and **showcab** commands

Both commands are examples in the source code to show how to add new command subroutines in console mode. Nothing happens on the screen when you execute both of these commands.

Chapter 5

Test Application

This chapter defines the tests that can be run on the modem by using a test application created from the test image file (TestApp.hex).

Topic **Page**

5.1 TestApp.hex 5-2
5.2 PHY Tests Menu 5-5
5.3 Take Over Point Measurement and Setup 5-8

5.1 TestApp.hex

The TNETC400E reference design kit includes a test image file (TestApp.hex). This image file can be downloaded to the flash sector and enables the user to execute various tests on the modem. When the modem is running this test application it does not scan the entire bandwidth to try to sync as in operation mode. However, for testing purposes it enables the user to force the modem to try and sync to a certain frequency. To run this test application, first download (dl) the file into an empty sector and set it to be the default boot sector.

```
LBT400> setdef 2
Setting default sector to 2
LBT400> dir
Directory of LBT400 Flash (Checking CRC, Please wait ...)
   Sec#1  lbt400e_ver2.13_mar28.img
CRC OK
–> Sec#2  TestApp400E_apr06.img
CRC OK
LBT400> reboot
```

5.1.1 TestApp Commands

help/h

After rebooting from the test-image file, the modem gets to test application's console mode. Type help to get the available tests and commands, which are detailed on the following display.

```
LBT400E – TI–CBC MCNS Cable Modem Board
––––––––––––––––––––––––––––––––––––––––––––––––––––––––––
IP address on LAN is 10.0.5.101
LAN interface's subnet mask is 255.255.255.0
Serial channels will use a baud rate of 9600
Ethernet hardware address is 0:50:F1:10:20:21
––––––––––––––––––––––––––––––––––––––––––––––––––––––––––
Console> help
Console Commands:
help / h          – Display this message.
r <reg>           – Read from PHY register <reg>.
w <reg>,<data>    – Write <data> to PHY register <reg>.
macr <reg>        – Read from MAC register <reg>.
macw <reg>,<data> – Write <data> to MAC register <reg>.
sr <addr>         – Read from SRAM.
sw <addr>,<data>  – Write <data> to SRAM.
p                 – Display status of PHY
t <freq>          – Program the tuner to <freq>(Mhz)
gain <dB>         – Control the upstream gain
phyinit           – Init PHY
tests / ts        – LBT400 Tests
ver               – Print the currnet software version.
settop            – Set the TOP table in NVRAM
––> Numbers can be in deecimal (NNNN) or hex (0xNNNN)
Console>
```

r <reg>
w <reg>,<data> command

Read/write from/to thePHY registers. For example:

```
Console> r 0x68
Value in register 0x68 is 0x2021.
Console>
Console> w 0x0d, 0xf0
Writing value 0xF0 to register 0xD.
Console>
```

macr <reg>
macw <reg>,<data> command

Read/write from/to the MAC registers.

```
Console> macr 0x7fa06
Value in register 0xFFA06 is 0x1101.
Console> macw 0x7940c,0
Writing value 0x0 to register 0xF940C.
Console>
```

sr <addr> and
sw <addr>,<data> command

Read/write from/to the SRAM.

```
Console> sr 0x1fff
Value in SRAM:
1FFF: FF4D E14C 9F3F 5FB7 3DE7 D7F7 B2B7 BD9D
200F: FA27 BBED FA67 BD3D FFF1 DF16 BBFE FB84
201F: CBBD FDBF F7D6 AB6D EF47 E396 BE5F F7B6
Console> sw 0x1fff,0
Writing value 0x0 to addr 0x1FFF.
Console>
```

p command

Displays the PHY status. If you want to observe PHY status continuously, use the 6 command on the PHY test menu. See section 5.2, the PHY Tests Menu.

```
Console> p
Current PHY status:
MSE – –34.536 dB
Timing Offset – –10.309 ppm
Carrier Offset – 61.346 Hz
AGC Gain – 197
Qam mode – 256 QAM
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Console>
```

t <freq> command

Sets the tuner to a desired downstream frequency.

```
Console> t 333
TOP value: 0x200
 Setting tuner to 333.00 MHz.
 Reseting PHY ...
Console>
```

gain <dB> command

Adjusts the gain of upstream output power. The gain values could be between 0~63dB.

```
Console> gain 61
Setting gain to 61.00 dB.
Console>
```

phyinit command

Resets all PHY registers to default values. See section 5.2 for details.

tests / ts command

Enters the PHY test menu.

ver command

Displays the current software version.

```
Console> ver
Console Version 3.12 – Mar 2, 2000
Console>
```

settop command

To find the right parameters in the settop command, a measurement procedure to the modem must be performed. This procedure is detailed in section 5.3: Take Over Point Measurement and Setup.

5.2 PHY Tests Menu

Typing tests or ts on the test application screen gets the modem into a sub menu called PHY tests menu.

```
Console> ts
Available tests:
  1       – Test DRAM
  2       – Test MAC
  3       – Test PHY
  6 <sec> – PhyStat for <sec> seconds
  7 <n>   – Test SRAM (circular write/read)
  8       – LED Check
  9 <n>   – MAC Write/Read for <n> times
  r <reg> – Read from PHY register <reg>
  w <reg>,<data> – Write <data> to PHY register <reg>
Downstream:
  t <freq>– Program the Downstream Tuner to <freq> Mhz
  b <sec> – BER Cehck for <sec> seconds
Upstream:
  f <freq>– Set Upstream transmit frequency to <freq> Mhz
  g <gain>– Set Upstream transmit gain to <gain> dB (0–63)
  m <mod#>– Set Upstream Modulation type (1=QPSK, 2=16QAM)
  s <symb>– Set Upstream Symbol Rate to <symb>*160KSym/sec
(1,2,4,8,16)
  c <mode>– Set Upstream Continues Mode (0=None, 1=Data, 2=Sin)
  u <n>   – Transmit Upstream Bursts for <n> times (100 = ~7 sec)
  0. Back to Commands
Pick a test (? for help)>
```

Following is a description of the commands:

1 – Test DRAM command

Writes and then reads back several patterns to check if the DRAM is working properly.

```
Pick a test (? for help)> 1
DRAM test ... OK
Pick a test (? for help)>
```

2 – Test MAC command

Writes and then reads back several patterns to check if the MAC BD memory is working properly.

```
Pick a test (? for help)> 2
MAC test ... OK
Pick a test (? for help)>
```

3 – Test PHY command

This test is no yet implemented. It is reserved for future use.

6 <sec> – PhyStat for <sec> seconds command

This test is used to observe the status continuously for a few seconds. It helps when we want measure the TOP(Take Over Points).

```
Pick a test (? for help)> 6 6
PhyStat for 6 seconds ...
PhyStat for 6 seconds ... (Left 0 sec.)
Current PHY status:
MSE – –30.751 dB
Timing Offset – –9.271 ppm
Carrier Offset – –30.673 Hz
AGC Gain – 301
Qam mode – 256 QAM
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Pick a test (? for help)>
```

7 <n> – Test SRAM (circular write/read) command
<n> is the number of cycles to perform the test.

If the tuner is already set to receive a downstream signal (i.e., if the tuner is set to a valid downstream channel), this test would fail because the SRAM is being used as that downstream buffer.

```
Pick a test (? for help)> 7 2
SRAM test 2 times .....OK
Pick a test (? for help)>
```

8 – LED Check command

This command causes the following LEDs to turn on for two seconds:

Internal LEDs (on-board): LED1 to LED6

Front panel LEDs: Power, STATUS, CBL–Rx, CBL–Tx

The LAN LEDs are physically connected to the LAN interface. This is why the LED test does not control them.

Test application version LBT400E_TestApp.hex 18th of April does not control the STATUS LED.

9 <reg>,<n> – MAC Write/Read for <n> times command

You can write/read a MAC register to verify it.

```
Pick a test (? for help)> 9 0x78000,2
MAC Write/Read to 0x78000 test 2 times ...
..
Pick a test (? for help)>
```

r <reg> – Read from PHY register <reg> and
w <reg>,<data> – Write <data> to PHY register <reg> commands

You can read from and write to the PHY registers directly, as shown in the following example.

```
Pick a test (? for help)> r 0x0d
Value in register 0xD is 0x200.
Pick a test (? for help)>
Pick a test (? for help)> w 0xd,0xf0
Writing value 0xF0 to register 0xD.
Pick a test (? for help)> r 0xd
Value in register 0xD is 0xF0.
Pick a test (? for help)>
```

t <freq> – Program the Downstream Tuner to <freq> MHz and
b <sec> – BER Check for <sec> seconds commands

You can tune the downstream frequency for test. The BER is not implemented now.

```
Pick a test (? for help)> t 333
TOP value: 0x200
 Setting tuner to 333.00 MHz.
 Reseting PHY ...
Pick a test (? for help)>
```

t <freq> – Set upstream transmit frequency to <freq> MHz
g <gain> – Set upstream transmit gain to <gain> dB (0-63)
m <mod#> – Set upstream modulation type (1= QPSK, 2=16QAM)
s <symb> – Set upstream symbol rate to <symb>* 160KSym/sec (1,2,4,8,16)
c <mode> – Set upstream continues mode (0=None, 1=Data, 2=Sin)
u <n> – Transmit upstream bursts for <n> times (100 = –7 sec) commands

You can also change the upstream frequency, output power, modulation type, and symbol rate. The following example is to continuously transmit 160ksym/sec upstream QPSK data bursts with gain 61 at 37.5MHz.

```
Pick a test (? for help)> f 37.5
 Setting US Frequency to 37.500 MHz.
Pick a test (? for help)> g 61
Set gain to 61 dB
Pick a test (? for help)> m 1
Set Modulation to QPSK
Pick a test (? for help)> c 1
Set Continues to Data
Pick a test (? for help)> s 1
Set Symbol Rate to 160 KSymbol/Sec
Pick a test (? for help)> u 1
Upstream transmit Bursts 1 times ...
.
```

```
Finished
Pick a test (? for help)>
```

The upstream bursts are not changed until another u command is executed.

5.3 Take Over Point Measurement and Setup

This paragraph describes the required procedure for measuring the take-over-points (TOP) between the RF AGC and the intermediate frequency (IF) AGC. After measurements, the CM should be configured accordingly using those points. This configuration is to get a uniform AGC response along with the IF and the RF frequencies. This procedure is usually done along the final test procedure as part of the manufacturing process.

5.3.1 Test Setup

The following setup shown in Figure 5–1 is recommended for TOP measurement:

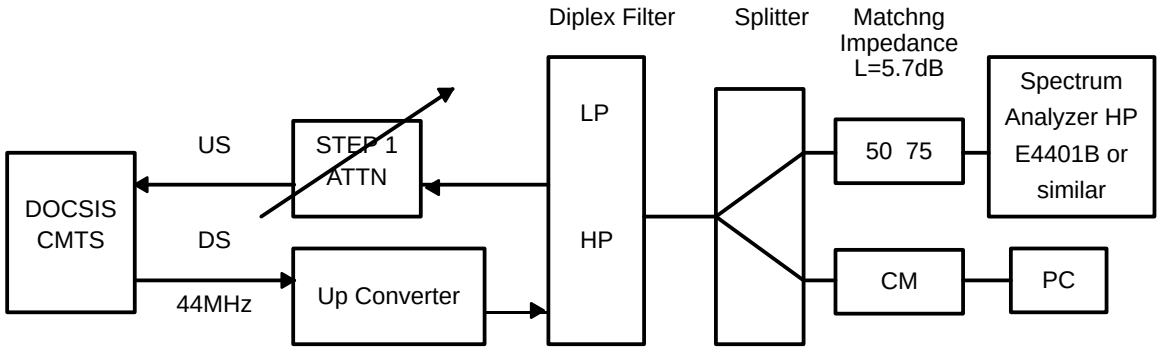

Figure 5–1. TOP Measurement Setup

The spectrum analyzer should be set to have Ext Amp Gain at –5.7dB to compensate for the loss of the 50–75 impedance converter. However, the power at the input of the impedance converter and at the input to CM should be the same. Set the spectrum analyzer's ext amp gain parameter for achieving this condition.

5.3.2 TOP and Mean Square Error (MSE) Measurement

Preparation

1) The tuner's gain varies with temperature, therefore the tested CM should be warmed up. Measurement should be performed on a CM, that has been is powered on for about 30 minutes before testing.

2) Set CMTS DS to 256QAM.

Measure TOP and MSE @ –6dBmV

3) Boot the CM from the test-image file.

4) Set LO at the desired frequency according to Table 5–1. Table 5–1 is not required for the procedure, however, it allows the efficient setting of the modems.

5) Set the CM tuner at a relevant frequency (Fo=LO–44).

6) Adjust the gain control of the up converter to get –6dBmV (or 42.75dBm) power level (integration BW:6 MHz), record the step attenuation values in Table 5–1, signal gain attenuation of the up converter.

7) Type in ts to enter the CM test menu

8) Run test 6 in CM test menu for 10 seconds to observe PHY status, and record the gain and average MSE values in the TOP dec and MSE @ –6dBmV of Table 5–1.

Measure TOP and MSE @ –15dBmV

9) Adjust the gain control of the up converter to add 9dB attenuation to get a –15dBmV(or 33.75dBm) power level.

10) Run test 6 in CM test menu for 10 seconds to observe PHY status, and record the average MSE in the MSE @ –15dBmV of Table 5–1.

11) Repeat steps 4 through 10 for all 10 frequencies. See the example in Appendix B.1.

12) Convert all TOP dec decimal values to TOP Hex hex values.

13) Leave the test menu by typing 0.

Setting TOP in A Cable Modem

14) In the CM console mode, type settop to enter TOP setup.

15) Type M to modify, then key in the Fo frequency and its relevant TOP dec value. Then type N for the next point.

16) Repeat this step until all 10 points are completed.

17) Finally, type S to show all TOP frequencies and their gain values for double check. See the example in Appendix B.2.

Verify the TOP

18) In the CM console mode, type t <freq> to set the tuner frequency in between the 10 test Fo frequencies. The command returns a hex TOP value.

19) Check if the returned TOP hex value of the tuner frequency is also in between those values of higher and lower Fo frequencies in Table 5–1.

20) Try several different tuner frequencies to ensure that TOP is set properly.

Measure MSE @ +15dBmV

21) Start to measure MSE at +15dBmV. Set LO at the desired frequency, and in CM console mode set the CM tuner at the relevant Fo frequency.

22) Adjust the gain control of the up converter to reduce attenuation to get +15dBmV(or 63.75dBm) power level.

23) Run test 6 in CM test menu for 10 seconds to observe PHY status, and record the average MSE in the MSE @ +15dBmV of Table 5–1.

24) Repeat Step 17 through 19 for all 10 frequencies.

Table 5–1. TOP and MSE Setting/Measurement

No.	Fo [MHz]	Local Oscillator frequency [MHz]	Sig. Gain Atten. of up convrt. for –6 dBmV	TOP Dec.	TOP Hex.	MSE@ +15 dBmV [dB]	MSE@ –6dBmV [dB]	MSE@–15 dBmV [dB]	Notes
1	93	137							256QAM
2	153	197							256QAM
3	213	257							256QAM
4	273	317							256QAM
5	333	377							256QAM
6	393	437							256QAM
7	453	497							256QAM
8	573	617							256QAM
9	753	797							256QAM
10	855	899							256QAM

Appendix A

Report Levels

This appendix gives code examples of the output you receive when report levels are sent to specific console command levels.

A.1 Report Levels A-2

A.1 Report Levels

If you set report level 18 (IP applications) by the console command replevel 18, you can check the DHCP, TOD and TFTP values that the modem acquires. This tells you the IP addresses in the system and helps you in debugging the system when the registration process fails.

```
                ***********************************
                ** TI–CBC Signal Processing LTD  ***
                **   DOCSIS based Cable Modem   ***
                ***********************************
        Version 1.41  – Creation Date/Time:  Dec 15 1998 / 17:28:46
public key generation ................. generated OK.
Press <CTRL+d> to enter Console mode
DHCP : Entering Idle State
Trying to synchronize – searching...
SYNCHRONIZED – 202500000 Hz , ucd 1
Trying to register through CMTS...
DHCP : Start message received
DHCP: sending DHCP–DISCOVER size 548
DHCP: received DHCP–OFFER
DHCP: Setting (*) CM IP address to: 137.71.90.213
DHCP: Setting (*) CM TFTP Server address to: 137.71.91.100
DHCP: Setting (*) CM Gateway address to: 137.71.90.197
DHCP: Setting (*) CM Time Server address to: 137.71.91.100
DHCP: Setting (*) CM Time Server address to: 137.71.91.200
Gateway: 137.71.90.197
SubNetMask: 255.255.255.192
DHCP: sending DHCP–REQUEST
DHCP – setting info : RenewTime = 536870910 , RebindTime = 536870911
DHCP: received DHCP–REQ–ACK
DHCP: Setting CM IP address to: 137.71.90.213
DHCP – parameters acquired
TOD: The date is: 15/12/1998
TOD: The time is: 19:36:35
Time of day – retrieved
TFTP Start Request: going active
TFTP: Starting...
TFTP: Starting for the file <test.cfg> on server 137.71.91.100
TFTP: Downloading parameter file
TFTP download completed...
TFTP: Succeed... going inactive
Registration file – downloaded
REGISTRATION COMPLETE – MODEM IS ACTIVE
```

If you set report level 8 (synchronization process) by the console command replevel 8, you can check the downstream and upstream lock process, especially the ranging responses from the CMTS and Sync problems. See the example below:

```
                  **********************************
                  **      Texas Instruments       ***
                  **   DOCSIS based Cable Modem   ***
                  **********************************
        Version 2.13 – Creation Date/Time:  Mar 28 2000 / 20:43:18
Press <CTRL+d> to enter Console mode
Trying to synchronize ...
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 2264. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 0. Freq: 0
SYNCHRONIZED – 202500000 Hz , ucd 1
Trying to register through CMTS...
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 0. Freq: 0
DHCP – parameters acquired
Time of day – retrieved
Registration file – downloaded
REGISTRATION COMPLETE – MODEM IS ACTIVE
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 0. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 0. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:6.00), Time: 0. Freq: 0
 SYNC: T4_TIMEOUT.
Synchronization LOST <202500000 Hz – ucd 1, msg 10>
Trying to synchronize – searching...
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 2263. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
SYNCHRONIZED – 202500000 Hz , ucd 1
Trying to register through CMTS...
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
DHCP – parameters acquired
Registration file – downloaded
REGISTRATION COMPLETE – MODEM IS ACTIVE
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: –3. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 2. Freq: 0
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
```

Appendix B

Measure TOP and MSE @ –15dBmV

This appendix describes TOP process. It completes Section 5.3.2.

B.1 Measure TOP and MSE @ –15dBmV? B-2

B.2 Take Over Point (TOP) Code B-5

B.1 Measure TOP and MSE @ –15dBmV

```
------------------------------------------------------------------------
  IP address on Lan is 10.0.5.101
  The Lan interface subnet mask is 255.255.255.0
  Serial channels use a baud rate of 9600
  The ethernet hardware address is 0:50:F1:10:20:81
------------------------------------------------------------------------
Console> t 93
TOP value: 0x200
 Setting tuner to 93.00 MHz.
 Reseting PHY ...
Console> ts
Available tests:
  1       – Test DRAM
  2       – Test MAC
  3       – Test PHY
  6 <sec> – PhyStat for <sec> seconds
  7 <n>   – Test SRAM (circular write/read)
  8       – LED Check
  9 <n>   – MAC Write/Read for <n> times
  r <reg> – Read from PHY register <reg>
  w <reg>,<data> – Write <data> to PHY register <reg>
Downstream:
  t <freq>– Program the Downstream Tuner to <freq> Mhz
  b <sec> – BER Cehck for <sec> seconds
Upstream:
  f <freq>– Set Upstream transmit frequency to <freq> Mhz
  g <gain>– Set Upstream transmit gain to <gain> dB (0–63)
  m <mod#>– Set Upstream Modulation type (1=QPSK, 2=16QAM)
  c <mode>– Set Upstream Continues Mode (0=None, 1=Data, 2=Sin)
  0. Back to Commands
Pick a test (? for help)> 6 10
PhyStat for 10 seconds ...
PhyStat for 10 seconds ... (Left 0 sec.)
Current PHY status:
MSE – –34.313 dB
Timing Offset – –4.315 ppm
Carrier Offset – –1063.339 Hz
AGC Gain – 234
Qam mode – 256 QAM
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Pick a test (? for help)> 6 10
PhyStat for 10 seconds ...
PhyStat for 10 seconds ... (Left 0 sec.)
Current PHY status:
MSE – –31.563 dB
Timing Offset – –4.456 ppm
Carrier Offset – –1247.378 Hz
AGC Gain – 269
```

```
Qam mode – 256 QAM
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Pick a test (? for help)> 0
Bye.
Console> t 153
TOP value: 0x200
 Setting tuner to 153.00 MHz.
 Reseting PHY ...
Console> ts
Available tests:
  1       – Test DRAM
  2       – Test MAC
  3       – Test PHY
  6 <sec> – PhyStat for <sec> seconds
  7 <n>   – Test SRAM (circular write/read)
  8       – LED Check
  9 <n>   – MAC Write/Read for <n> times
  r <reg> – Read from PHY register <reg>
  w <reg>,<data> – Write <data> to PHY register <reg>
Downstream:
  t <freq>– Program the Downstream Tuner to <freq> Mhz
  b <sec> – BER Cehck for <sec> seconds
Upstream:
  f <freq>– Set Upstream transmit frequency to <freq> Mhz
  g <gain>– Set Upstream transmit gain to <gain> dB (0–63)
  m <mod#>– Set Upstream Modulation type (1=QPSK, 2=16QAM)
  c <mode>– Set Upstream Continues Mode (0=None, 1=Data, 2=Sin)
  0. Back to Commands
Pick a test (? for help)> 6 10
PhyStat for 10 seconds ...
PhyStat for 10 seconds ... (Left 0 sec.)
Current PHY status:
MSE – –34.888 dB
Timing Offset – –4.919 ppm
Carrier Offset – –1615.457 Hz
AGC Gain – 237
Qam mode – 256 QAM
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Pick a test (? for help)> 6 10
PhyStat for 10 seconds ...
PhyStat for 10 seconds ... (Left 0 sec.)
Current PHY status:
MSE – –31.584 dB
Timing Offset – –4.999 ppm
Carrier Offset – –1574.560 Hz
AGC Gain – 273
Qam mode – 256 QAM
```

```
QAM Lock – YES
FEC Sync – YES
MPEG Sync – YES
Weak signal – NO
Pick a test (? for help)> 0
Bye.
Console> t 213
TOP value: 0x200
 Setting tuner to 213.00 MHz.
 Reseting PHY ...
Console>
```

B.2 Take Over Point (TOP) Code

```
Console>
Console> settop
TakeOverPoint table configuration
(#01): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :93
 TOP :237
(#01): Freq=93  TOP=237
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#02): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :153
 TOP :238
(#02): Freq=153  TOP=238
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#03): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :213
 TOP :245
(#03): Freq=213  TOP=245
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#04): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :273
 TOP :243
(#04): Freq=273  TOP=243
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#05): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :333
 TOP :241
(#05): Freq=333  TOP=241
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#06): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :393
 TOP :240
(#06): Freq=393  TOP=240
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
```

```
(#07): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :453
 TOP :238
(#07): Freq=453  TOP=238
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#08): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :573
 TOP :244
(#08): Freq=573  TOP=244
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
n
(#09): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :753
 TOP :231
(#09): Freq=753  TOP=231
(#09): Freq=753  TOP=231
n
(#10): Record not valid
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
m
 Frequency (0–invalidate record) :855
 TOP :232
(#10): Freq=855  TOP=232
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
s
(#01): Freq=93  TOP=237
(#02): Freq=153  TOP=238
(#03): Freq=213  TOP=245
(#04): Freq=273  TOP=243
(#05): Freq=333  TOP=241
(#06): Freq=393  TOP=240
(#07): Freq=453  TOP=238
(#08): Freq=573  TOP=244
(#09): Freq=753  TOP=231
(#10): Freq=855  TOP=232
(#10): Freq=855  TOP=232
(M)odify, (N)ext, (P)revious, (S)how all or (Q)uit
q
Console>
```

If you set report level 22 (cable modem messages) by the console command replevel 22, you can check any of the modem messages and truck down problems. For example:

```
CONSOLE> tuner 202.5
tuner: <202500000Hz>
tuner message sent
MSG :ACTION: CONSOLE TUNER COMMAND WITH DS 202500000 [ 'cm action']
CONSOLE> Trying to synchronize – searching...
MSG :INDICATION: HARDWARE_ALARM – (Time Track Error) []
MSG :INDICATION: QAMLOCK [ '']
MSG :INDICATION: DSSYNC [ '']
MSG :INDICATION: TRYCHANNELID – (1) [ '']
MSG :INDICATION: VALIDUCD – (1) []
MSG :INDICATION: INITRANGING – (RNG_CONTINUE) [ '']
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
MSG :ACTION: DATAMODE [ 'SYNC COMPLETE']
SYNCHRONIZED – 202500000 Hz , ucd 1
Trying to register through CMTS...
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
MSG :ACTION: DHCP_END [ 'cm action']
DHCP – parameters acquired
MSG :ACTION: CONFIG FILE WITH UCD 1 [ 'cm action']
MSG :ACTION: TFTP_END [ 'cm action']
Registration file – downloaded
MSG :ACTION: REGCOMPLETED [ 'REGISTRATION DONE']
REGISTRATION COMPLETE – MODEM IS ACTIVE
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
MSG :RANGING: PERDRANGING – (RNG_CONTINUE) [ '']
MSG :RANGING: PERDRANGING – (RNG_CONTINUE) [ '']
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
```

Report level 8 and 22 will generate the following:

```
CONSOLE> replevel 8
 report levels on : 1 8 22
CONSOLE> SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
SYNC: RNG–RSP: d–Gain: 0.00 (New Gain:5.00), Time: 0. Freq: 0
MSG :RANGING: PERDRANGING – (RNG_SUCCESS) [ '']
```