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Z02215

*Single-Chip Modem
Evaluation Board*

User Manual

UM002304-0802

Preliminary

Z02215 Single-Chip Modem Evaluation Board User Manual



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Preface

ABOUT THIS MANUAL

We recommend that the user read and understand everything in this manual before setting up and using the product. However, we recognize that users have different styles of learning. Some want to set up and use their development board while they read about it; others open these pages only as a last resort to check on a particular specification. Therefore, we have designed this manual to be used either as a how-to procedural manual or a reference guide to important data.

The complete development board schematic diagram is included in Chapter 4 at the back of this user's manual.

For technical support, send an email to: modemsupport@zillog.com, or call 877-ZILOGCS (877-945-6424)

DOCUMENT CONVENTIONS

The following conventions have been adopted throughout this book for consistency and clarity:

- **Italics For Emphasis**

Words which require special emphasis are distinguished by the use of italics. For an example, the third and subsequent actions are preceded by the word *and..*

- **Courier Font For Executables**

Commands, variables, icon names, entry field names, selection buttons, code examples, and other executable items are distinguished by the use of the Courier font. Where the use of the font is not possible, like in the Index, the name of the entity is capitalized. For example, a procedure may contain an instruction which appears as: Click on `File`.



- Grouping of Actions Within A Procedure Step

Actions in a procedure step are all performed on the same window or dialog box. Actions performed on different windows or dialog boxes appear in separate steps.

- Sequencing Words Within A Procedure Step

When an item in a procedure contains a series of actions, the second action is preceded by the word *then*, and the third and subsequent actions are preceded by the word *and*. For example: Click on `File`, then `Import`, and `File`.

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Introduction

OVERVIEW

The Z02215™ Modem Evaluation Kit (Z0221500ZCO) provides a platform that allows evaluation of the ZiLOG Z02215 single-chip modem. The evaluation board (including the Z02215 Single-Chip Modem) is a fully-functional modem that supports AT commands.

Modem code contained in Z02215's on-chip ROM includes V.22bis, V.22, V.21, V.23, Bell 103, Bell 212A, Bell 202, and Bell 202T as well as basic data pump driver routines, AT commands, plus other controller code.

The evaluation board provides one serial port interface with a DB25 connector and a phone line interface through the RJ-11 connector. A power supply is provided that converts 110V AC power to +12V AC.

KEY FEATURES

- Z02215 Single-Chip modem DSP, Analog Front End, controller, and on-chip ROM to hold all modem firmware.
- RS-232 DB25 port interface
- Telephone line interface with RJ-11 jack
- LED indicators
- Speaker
- Operates from single 12V AC, 1 Amp wall adapter power supply



RELATED ZILOG PRODUCTS

Device	Description
Z02215	2400 bps Single-Chip Modem
Z02202	2400 bps Modem Data Pump + Analog Front End
Z02923	9600 bps Modem Data Pump + Analog Front End
Z02205	Modem Controller

HARDWARE SPECIFICATIONS

Dimensions	4.50-in. height x 6.00-in. width
Oscillator Frequency (OSC)	24.576 MHz for Z02215
Host Interface	RS-232 DB25 serial interface
Serial Data Rate from Terminal	9600 BPS (max)
Power Supply Voltage	+12V AC
Power Supply Current	1 Amp
Operating Temperature	20° C, ±10° C
Operating Humidity	10-90% RH (Noncondensing)

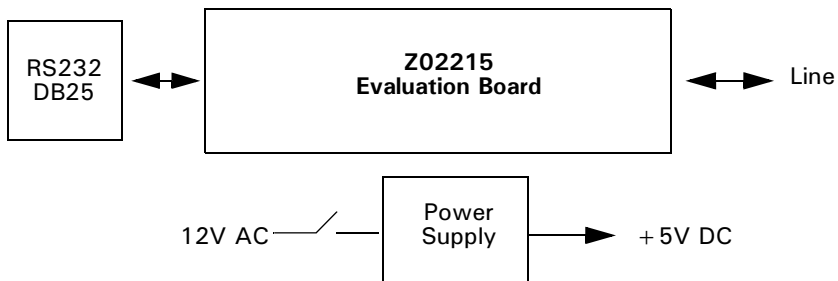


Figure 1. Z02215 Modem Evaluation Kit Functional Block Diagram



KIT CONTENTS

Hardware

- Z02215 V.22bis modem evaluation board
- 12VAC power converter (110V wall supply)
- Connector - female, 2.1 MM (inner diameter) by 5.5 MM (outer diameter)
- RJ11 phone cord (6-ft. length)

Software

- Diplomat™ Utility, including partial table files and hexadecimal files for the following countries: U.K., Germany, Japan, Korea, North America, Portugal, Spain, Australia, China, and France
- Biquad™ Filter Design Utility

Documentation

- Z02215 Modem Evaluation Kit User's Manual
- Z02215 Single-Chip Modem with Integrated Controller, Data Pump, and Analog Front End Product Specification
- Board schematic print files
- Evaluation board OrCAD and Gerber files

ADDITIONAL REQUIRED AND OPTIONAL ITEMS

Required Items Not Supplied With Kit

IBM PC (or compatible) with the following minimum recommended configuration:



- 486 CPU, 66 MHz
- 4-MB RAM
- Hard disk drive (1-MB free space)
- VGA video adapter
- 3.5-inch high-density floppy disk drive
- RS-232C communications port
- Windows 95

► **Note:** For increased performance, ZiLOG recommends a 486- or Pentium-based machine operating at 66 MHz or faster with 8 MB of RAM.



Setup and Installation

INTRODUCTION

This chapter provides the various steps necessary to test the functionality of the Z02215 single-chip modem, as demonstrated on the Z02215 modem evaluation board. A sample session to evaluate the Modem Evaluation board along with some troubleshooting tips are also provided.

The following sections are covered in this chapter:

- Setting Up the Hardware
 - Serial Port Interface
 - RJ11 Interface
 - Connecting to a Power Supply
- Software Configuration
- Diplomat™ Application
- Initial Checkout/Sample Session
- Troubleshooting

SETTING UP THE HARDWARE

Serial Port Interface

The Z0221500ZCO modem evaluation board includes one DB25 serial port interface. To interface with the PC Host, use the DB25-male to DB25-female cable. Connect the male end to the female connector on the side of the modem evaluation board, and the female end to either the COM1, COM2, COM3, or COM4 connector of your PC.



- ▶ **Notes:** Record the number of the serial port you selected. This information is necessary when configuring the terminal software on the Host PC.

If your PC has a DB9 serial port interface, get a DB25-male to DB9-female cable or an equivalent adapter to make the connection between the modem evaluation board and the host PC.

RJ-11 Interface

Connect the incoming phone line to the RJ11 jack.

- ▶ **Note:** An ANALOG phone line must be used. Digital phone lines can damage the modem. Most of the office phone lines are digital, so make sure the correct phone line is used.

Connecting to a Power Supply

A 12V AC wall adapter power supply is provided in the Modem Evaluation Kit. Connect the power adapter to the 12V AC jack on the Z02215 Modem Evaluation Board and plug in to a 110V AC supply.

- ▶ **Note:** The Power LED (red-PWR) along with the red DCD LED must glow when the power switch is turned ON. If not, check the 110V AC supply and the power supply connections.

Figure 2 shows the layout of Z02215 Modem Evaluation Board.

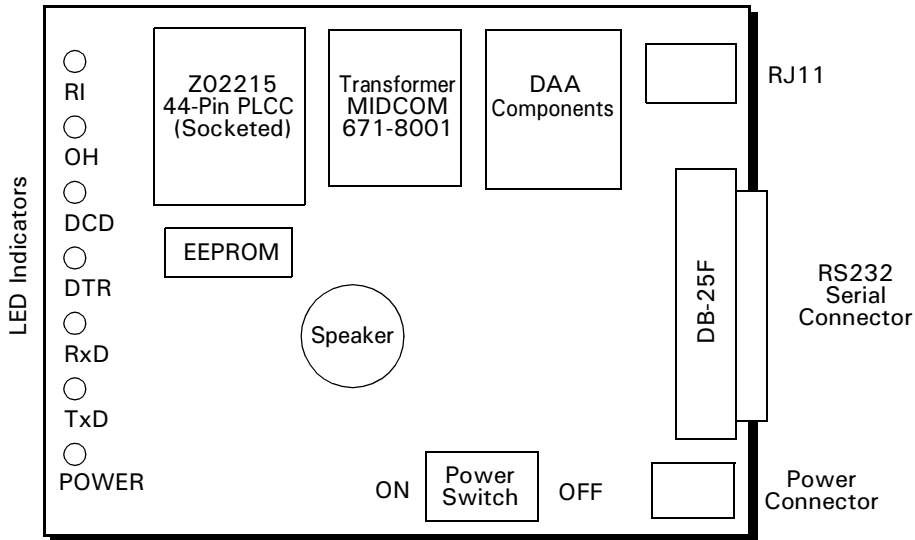


Figure 2. Z02215 Modem Evaluation Board

SOFTWARE CONFIGURATION

Assuming the hardware setup is complete, and the Modem Evaluation board is powered ON, perform the following steps:

1. Power-up the PC, and wait for the boot process to complete.
2. Launch the terminal program (PC host communication software), and change the communication settings to indicate the COM port number to which the modem-evaluation board is connected.

A terminal program (PC host communication software) is required for initialization, communication, and modem transmission.

3. Select a data rate of 2400 bps or less from the terminal program settings.

The 2400 bps setting is recommended.



ZiLOG's modem is capable of understanding commands at data rates of 300, 600, 1200, 2400, 4800 and 9600 bps. Any one of the data rates can be picked to initialize the modem. The characters may have a word length of 7 bits with parity or 8 bits with no parity.

The Z02215 Modem Evaluation Board is now ready to be configured by means of initialization commands sent asynchronously through the terminal program.

4. Initialize the modem by typing `AT&F<CR>` to the command line. This command returns a result:

OK.
5. Go to the Initial Checkout/Sample Session if the OK notice is echoed to the terminal.

Troubleshooting

If result codes do not appear after typing AT commands, the modem is not properly installed. Repeat the setup procedure to ensure all the hardware and software settings are correct.

If the modem is still not responding despite all the correct settings, check to make sure there are no conflicts between the COM port and IRQ settings through the Windows Control Panel.

COUNTRY CONFIGURATION

The default firmware on the evaluation board is configured for operation in North America only. Using the Diplomat™ utility program, the modem firmware can be modified for use in other countries.

The Diplomat Program

The Diplomat program modifies the modem firmware according to the parameters in a country profile. Partial country files end with a `.tb1` extension and are also called TB1 files..



Install Diplomat

Install diplomat, including country files, by performing the following procedure:

1. Insert the Diplomat installation diskette in a floppy drive.
2. Click on the Windows `Start` button.
3. Click on `Run`.
4. In the `Open` field of the `Run Window`, enter `A:\setup`.

The installer utility initiates the setup process. The `Welcome` window appears.

5. Click on `Next`.

The `Readme Information` window appears.

6. Read the information and click on `Next`.
7. Follow all on-screen instructions to complete the installation process.

Run Diplomat

To run the Diplomat program from Windows 95/98/NT, perform the following procedure:

1. Display the contents of the location where Diplomat is installed, for example:

```
C:\Zilog\Z0221512\
```

2. Right-click on a country files with an extension of `.tbl`.

To run the Diplomat program from MS-DOS™, perform the following procedure:

3. Set the current path to the directory containing the Diplomat files.



4. Enter the following command at the command prompt:

```
diplomat-i<nvram> -c<tb1 file> [-o<output file>] [-n] [-p{1|2|3|4}]
```

This command uses the following notation:

< >	Symbolic items
[]	Optimal items
{a b c}	Any of a, b, or c are valid items
<nvram file>	The name of a Z02215 Intel™ hex format NVRAM image (or ROM image). Use an NVRAM image that operates similarly to the desired behavior of your customized version, so parameters not specified in the TB1 file is copied from the <nvram file> to the output NVRAM image unchanged. For example, when preparing a customized NVRAM image for France, use the NVRAM image <code>france.hex</code> .
<tb1 file	The name of a Z02215 parameter file, containing the parameters to be changed in <nvram file>.
<output file>	The name of the Intel hex format output NVRAM image. The <code>-p</code> option enables the output to be downloaded directly into a modem.
-n	The file <nvram file> may be an entire Z02215 ROM image. In this case, Diplomat generates an output ROM image by default. The <code>-n</code> parameter causes Diplomat to generate an Intel hex format NVRAM image suitable for programming an NVRAM or downloading into a modem. NVRAM images are less than 16 KB in length; ROM images are larger.
-p{1 2 3 4}	Download the output NVRAM image directly into the modem attached to the specified COM port (1 through 4).

For example, the command `diplomat -inorthan.hex -cmy.tb1 -p1` uses the NVRAM image `northan.hex`, the parameter file `my.tb1`, and downloads the output NVRAM image to the Z02215 modem attached to COM1 (`-p1`).

To create a customized TB1 parameter file, make a copy of an existing TB1 file and modify it using a text editor such as the Windows Notepad™. Released TB1 files contain comment lines describing the parame-



ters. If a parameter is not included in a TB1 file, that parameter's value is taken from the `<nvrn file>` specified to Diplomat.

- ▶ **Note:** The Terminal program and the Diplomat utility program cannot be used simultaneously.

TB1 Parameter File Format

- ▶ **Note:** Timers are implemented as a single-timer interrupt divided down to lower frequencies in software. As a result, the measured times have an error tolerance of 1 in the units timed. For example, a timer count of 27 in units of 100 ms time from 2600 to 2600 milliseconds. The time interval from the setting of the timer until the next 100 ms. Timer tick varies from 0 ms to 100 ms. This variability affects only the first timer tick after a timer is set.

The Z02215 Parameter File Format has the following attributes that can be changed using any text editor:

- ON/OFF Controls
- Call Progress Detection Frequencies
- Ring Detection
- Line-In-Use
- DTMF Transmit Levels
- Tone Detection Threshold Levels
- Transmit Level Offset
- S-Registers Minimum, Maximum and Default Values
- Eye Quality Monitor Values
- Client Message



ON/OFF Controls

Parameter Name	Value	Description
ALLOW_BLIND_DIAL	1	Dial-tone detection is disabled. This parameter enables blind dialing and affects ATX.
	0	Require dial-tone detection.
ALLOW_BUSY_DISABLE	1	BUSY tone detection is disabled.
	0	Require BUSY tone detection.
BLIST_ENABLED	1	Enable dial blacklisting.
	0	Disable dial blacklisting.
CALLTONE_ENABLED	1	Use a V.25 calling tone when originating a call.
	0	Do not use a V.25 calling tone.
CID_ENABLED	1	Enable recognition of North American Caller ID. This parameter affects #CID.
	0	Disable recognition of North American Caller ID.
DISABLE_P_AFTER_T	1	Disable pulse dialing after tone dialing (prevents ATDT12P12).
	0	Enable pulse dialing after tone dialing.
DO_SWISS_BUSY	1	Detect BUSY tone for Switzerland
	0	Do not detect BUSY tone for Switzerland
DPSLEEP_DISABLE	1	Prevent the data pump from being put into Sleep mode when IDLE. Placing the data pump in Sleep mode reduces power consumption by approximately 50 mA. Disabling Sleep mode may increase the modem's reliability. Some modem designs experience occasional problems waking after Sleep.
	0	Put the data pump in Sleep mode when IDLE.



Parameter Name	Value	Description
DTMF_S11	1	Use S-Register S11 instead of DTMFINTER-DIGITMS (the time between each DTMF digit dialling) as the delay between dialed DTMF digits.
	0	Use DTMFINTERDIGITMS as the delay between digits.
FORCE_1800HZ_GT	1	Use an 1800-Hz GUARD tone.
	0	Do not use an 1800-Hz GUARD tone
FRANCE_CALL_DELAY	1	Use France call originate delay after ring.
	0	Do not use France call originate delay after ring.
LINE-SENSE-ENABLE	1	Determine if another telephone has the telephone line off-hook before taking the modem OFF-HOOK. This parameter affects ATA, ATD, auto-answer. See LINE_SENSE_ONLINE.
	0	Do not determine if another telephone has the telephone line OFF-HOOK before taking the modem OFF-HOOK.
LINE-SENSE-ONLINE	1	Determine if another telephone has the telephone line OFF-HOOK while the modem has the telephone line OFF-HOOK. See LINE_SENSE_ENABLE
	0	Do not determine if another telephone has the telephone line OFF-HOOK while the modem has the telephone line OFF-HOOK.



Parameter Name	Value	Description
MCSLEEP_DISABLE	1	Prevent the modem controller from being put to Sleep when IDLE. Placing the modem controller in Sleep mode reduces power consumption by approximately 8 mA. Disabling Sleep mode may increase the modem's reliability. Some modem designs experience occasional problems waking after Sleep. Regardless of the setting of MCSLEEP_DISABLE, the modem controller is not put into Sleep mode when dial blacklisting or the Watch-Dog Timer are used.
	0	Put the modem controller into Sleep mode when IDLE.
PTT_ALLOW_ABCD	1	Enable A,B,C,D DTMF tones to be issued.
	0	Disable A,B,C,D DTMF tones.
PTT_ALLOW_ATH1	1	Enable the modem to go OFF-HOOK. without handshaking.
	0	Disable the modem to go OFF-HOOK. without handshaking.
PTT_ALLOW_PULSE	1	Enable pulse dialing. This parameter affect ATD.
	0	Disable pulse dialing.
PTT_TEST_CMD	1	Enable the AT&HT command for PTT testing.
	0	Disable the AT&HT command.
USE_AP_CMD	1	Enable the setting of the pulse dial make/break ratio. This parameter affects AT&P.
	0	Disable the setting of the pulse dial make/break ratio.
VOICE_ANSWER	1	Detect voice answer.
	0	Do not detect voice answer.



Parameter Name	Value	Description
WATCHDOG_ENABLE	1	Use the modem controller's Watch-Dog Timer. This feature enables the Watch-Dog circuitry, which resets the modem if the modem controller stops operating successfully. Power fluctuations or firmware problems can cause the Watch-Dog Timer to reset the modem to its IDLE state. When the Watch-Dog Timer is used, the modem controller is not placed in Sleep mode, regardless of the setting of MCSLEEP_DISABLE. This feature is not supported in version 1.2 of the Z02215.
	0	Do not use the modem's Watch-Dog Timer.
Z02215_GPOB0	1	Output a +5-V signal on Z02215 pin PB2. Use this parameter to select a country-specific circuit in a general-purpose DAA.
	0	Output a +0-V signal on Z02215 pin PB2.
Z02215_GPOB1	1	Output a +5-V signal on Z02215 pin PB3. Use this parameter to select a country-specific circuit in a general-purpose DAA.
	0	Output a +0-V signal on Z02215 pin PB3.
Z02215_PARPHONE_DETECT	1	Enable the parallel Line-In-Use detection method. See the Line-In-Use section for a description of the two detection methods.
	0	Enable the Serial Line-In-Use detection method.
Z02215_USE_ACTIVEHYBRID	1	Use the Z02215 on-chip Active hybrid to cancel the transmitted signal from the received signal.
	0	Do not use the Z02215 on-chip Active hybrid. For example, if the DAA contains an Active hybrid, or if the modem connection is 4 wire.



Call-Progress Detection Frequencies

The modem detects telephone network conditions during call establishment using a biquad tone detector. This detector is configured by a set of coefficients to detect tones within a frequency band.

Different frequency ranges may be specified to Dial tone and the other call-progress tones (Busy, Congestion [fast busy], and Ring Back).

► **Note:** The coefficients are determined and written by the filter design program Biquad. Do not change these coefficients manually.

The parameter `CP_BQ*` contains the call-progress tone-detector coefficients. The call-progress detector follows the progress of the call after dialing. Tones such as Busy, Congestion [fast busy], and Ring-Back are detected by this detector.

The parameter `DIAL_HQ*` contains the dial tone detector coefficients. The Dial tone detector detects the Dial tone before the call is dialed.

Ring Detection

The modem controller detects ring cycles by monitoring the $\overline{\text{RDET}}$ signal. If a ring frequency is within the `RING_MAX_HZ` and `RING_MIN_HZ`, then a ring is detected; if not, a ring is not detected.

The parameter `RING_MAX_HZ` contains the upper bound of the ring signal in Hertz (cycles per second). The parameter `RING_MIN_HZ` contains the lower bound of the ring signal in Hertz (cycles per second).

Line-In-Use

Line-In-Use sensing may be performed both before the modem takes the telephone line OFF-HOOK to dial a number and during a connection.

Before Dialing

The `LINE_SENSE_ENABLE` parameter determines if the modem checks that another telephone has the telephone line OFF-HOOK



before the modem takes the telephone line OFF-HOOK to dial a number.

The Data Access Arrangement (DAA) provides a Line-In-Use circuit for the modem, connected to the combined Ring Detection and Line-In-Use input signal ($\overline{\text{RDET/LCS}}$). There are two methods of implementing the Line-In-Use circuit in a DAA. For *serial* phone detect, the circuit only detects if a telephone in series with the modem is OFF-HOOK. For *parallel* phone detect, the circuit detects if any telephone on the line is OFF-HOOK, including telephones wired in parallel to the modem. Serial and parallel phone detection schemes require different hardware and firmware support.

To perform parallel phone detection, the modem activates the line check circuit by driving the Line-Check output signal (LCS_CHK) Active for a period of time (X). During this time, the modem examines the Line- In-Use input signal ($\overline{\text{RDET/LCS}}$). If the Line-In-Use input remains active (0V) for a period of time (Y) while the Line-Check output signal is active, the line is deemed to be in use and the call is aborted.

To perform serial phone detection, the modem examines the Line-In-Use input signal ($\overline{\text{RDET/LCS}}$) for a period of time (X) without activating the Line-Check output signal (LCS_CHK). If the Line-In-Use signal stays active (0V) for a period of time (Y), within the check period (X), the dial attempt is permitted. Otherwise, the line is deemed to be in use, and the call is aborted.

Bit 7 of the Z02215_PARPHONE_DETECT parameter selects whether parallel or serial phone detection is required. The Line-In-Use function can be disabled by setting Bit 9 in PttBitmap0 (LINE_SENSE_ENABLE) to 0.