# World modem II

## Features

- Self-contained 300 – 56K baud modem family
- V.42, V.42bis, MNP4 Error Correction
- Compliant with global regulatory standards
- Standard & Extended AT command set
- Serial host interface
- Internal UART with HW/SW flow control
- Supports standard alarm protocols
- Caller ID, Call Progress & Fast Connect
- Phone Line Snoop and Tamper Detection
- Compatible with all Copeland Communications 2400, 14.4K, 33K and 56K high speed socket modems
- Socket Modem™ compatible
- Low power consumption – 3.3 V operation
- Low Power Standby Mode
- Small footprint – 1.045" X 2.54"

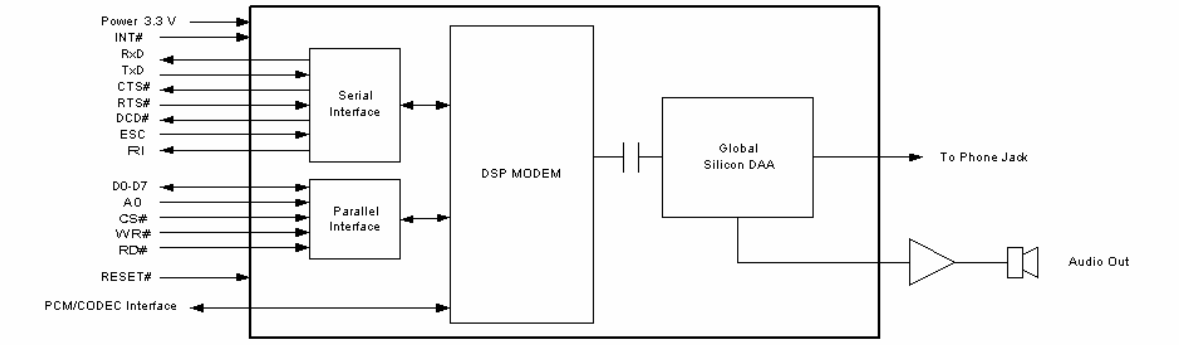
## Applications

- Global Embedded applications
- Point-of-sale terminals
- Set-top boxes
- Vending & gaming machines
- Security Systems
- Remote monitoring & control
- Remote telemetry and SCADA
- OEM applications
- Bridge for other CCI products

## Description

The CC56K World modem is a compact integrated 56Kbaud ITU-V.90 modem with Socket Modem™ compatibility. The modem features a transformer-less DAA meeting global telephone system requirements, no electro-mechanical components and flexible DSP data pump. The modem is user-configurable to meet virtually all global telecom requirements. The modem supports serial host communications via flexible internal UART. The modem conforms to the industry standard Socket Modem™ mechanical and interface specifications. Because of its built-in features and flexibility, many applications and OEM products can be created using the World Modem. The World Modem is an ideal modem for world-wide embedded applications due to its flexibility, global compliance, small size, low power consumption and upgradeability. Copeland Communications World modems are software and plug compatible and available in 2400, 14.4K, 33K or 56K baud versions .

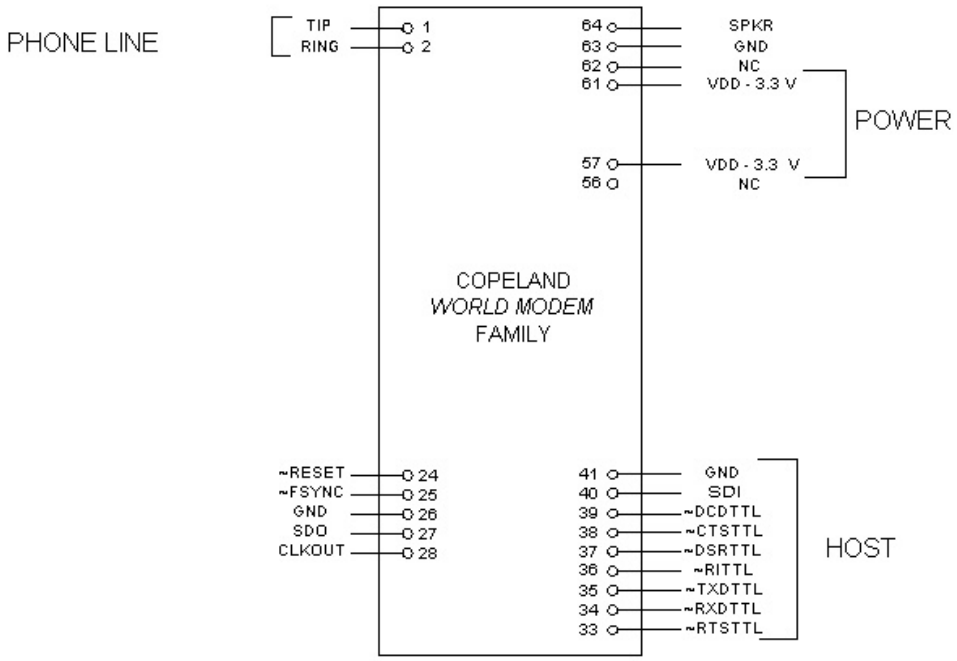
## Block Diagram






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## Host Interface




Note: Signals on pins 24,27,33-40 are TTL.

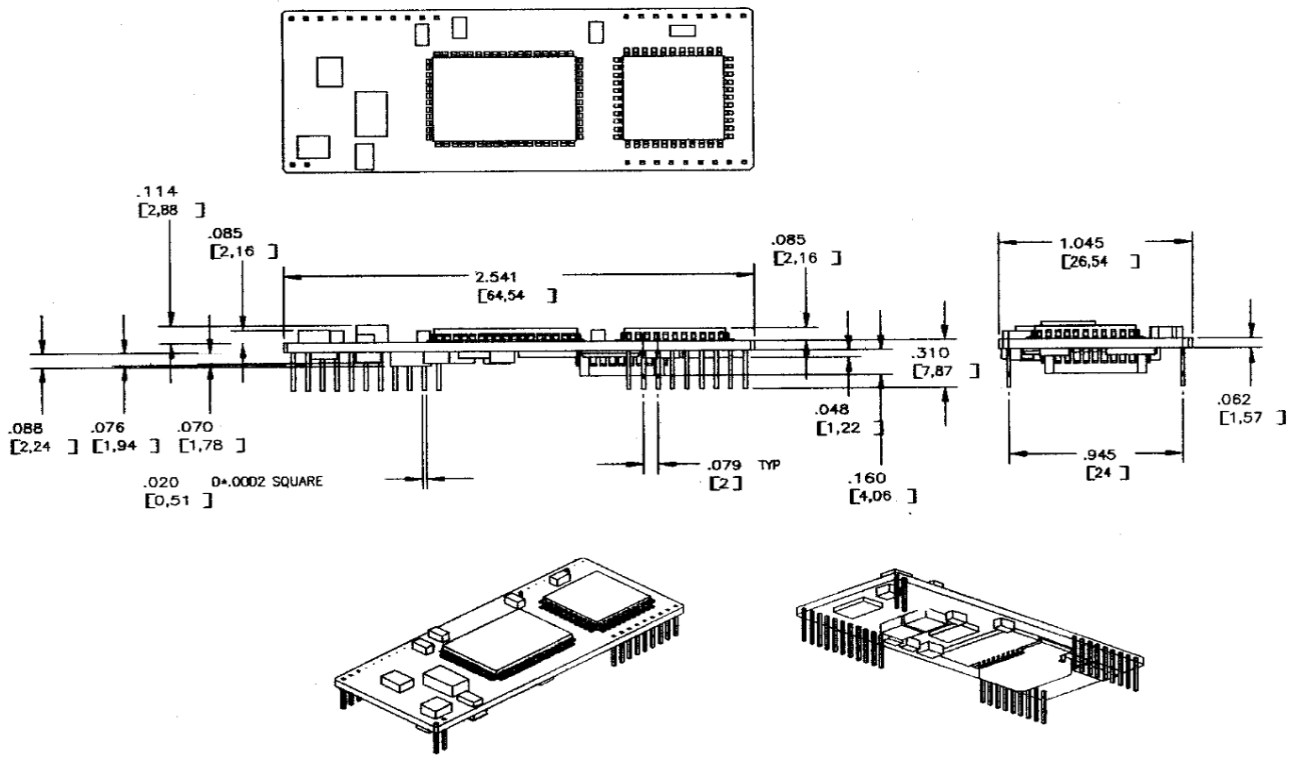
**Serial Host Interface**

The host interface control and data signals are 3.3volts and are 5 volt tolerant. The World modem II modems can be directly connected into 3.3 or 5 volt systems. Connect either pin 57 or pin 61 to 3.3V power supply.



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## Mechanical Outline




## Mechanical

The modem module is on an 0.062 thick FR-4 PC board. The module has two rows of 2mm pins located 24mm on center. The module is designed to plug into 2 mm sockets with the same 24 mm spacing.

Due to the low mass of the board, no retention is required aside from the sockets. A large tie-wrap may be used to insure retention in high shock or vibration environments, if desired.



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## Detailed Specifications

| Item | Specification |
|---|---|
| **Data Rate** | |
| 56K bps-28K<br>2400 bps – 33.6K bps<br>2400 bps – 14.4K bps<br>1200bps<br>300 bps | V.90<br>V.34<br>V.32bis<br>V.22, V.23 or Bell 212A<br>V.21 or Bell 103 |
| **Data Format** | |
| Bit format | Selectable 8,9,10 or 11 bits per character |
| Compatibility | V.23, V.22bis, V.21, Bell 212A & Bell 103 |
| Control | AT command set |
| **Host Interface** | |
| Serial | TTL - 8,9,10 & 11 bit asynchronous data @ 2400-19.2Kbps rate |
| Flow Control | CTS, RTS, DCD, RI |
| **Features** | |
| Caller ID | Bellcore (US) & ETSI (European) |
| PCM/CODEC | |
| Parallel Phone Detection | On-hook and off-hook detection |
| International Operation | Via programmable control registers |
| Dialing | DTMF & pulse |
| **Power Requirements**<br>Voltage<br>Current | <br>3.3 V Nominal<br>3.0V Minimum<br>3.6V Maximum<br>35 mA Operating Maximum<br>130 µA Standby Maximum |
| **Environmental** | |
| Temp Range | Commercial 0C-70C |
| **Compliance** [1] | FCC part 15<br>FCC part 68<br>EN50082-1<br>CTR-21 |

## Asynchronous Serial Interface

The Asynchronous Serial Interface is a complete UART consisting of Receive and Transmit signals as well as RTS, CTS, DSR, DTR, DCD and RI control signals. RTS/CTS, DSR/DTR and XON/XOFF flow control are supported.

The UART is programmable to support a number of baud rates and data formats. Supported data rates and formats are:

Data Bits: 8
Stop Bits: 1
Baud Rates: 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14.400, 19200, 28800, 38400, 56000, 57600, 115200, 128000, 230400, 460800, 921600



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## Protocols

| Item | Specification |
|---|---|
| **Data Rate** | |
| 56 kbps [1] | ITU-T V.90[1] |
| 54.666 kbps [1] | ITU-T V.90[1] |
| 53.333 kbps [1] | ITU-T V.90[1] |
| 52 kbps [1] | ITU-T V.90[1] |
| 50.666 kbps [1] | ITU-T V.90[1] |
| 49.333 kbps [1] | ITU-T V.90[1] |
| 48 kbps [1] | ITU-T V.90[1] |
| 46.666 kbps [1] | ITU-T V.90[1] |
| 45.333 kbps [1] | ITU-T V.90[1] |
| 44 kbps [1] | ITU-T V.90[1] |
| 42.666 kbps [1] | ITU-T V.90[1] |
| 41.333 kbps [1] | ITU-T V.90[1] |
| 40.0 kbps [1] | ITU-T V.90[1] |
| 38.666 kbps [1] | ITU-T V.90[1] |
| 37.333 kbps [1] | ITU-T V.90[1] |
| 36.0 kbps [1] | ITU-T V.90[1] |
| 34.666 kbps [1] | ITU-T V.90[1] |
| 33.333 kbps [1] | ITU-T V.90[1] |
| 32.0 kbps [1] | ITU-T V.90[1] |
| 30.666 kbps [1] | ITU-T V.90[1] |
| 29.333 kbps [1] | ITU-T V.90[1] |
| 28.0 kbps [1] | ITU-T V.90[1] |
| 33.6 kbps [2] | ITU-T V.34[2] |
| 31.2 kbps [2] | ITU-T V.34[2] |
| 38.8 kbps [2] | ITU-T V.34[2] |
| 26.4 kbps [2] | ITU-T V.34[2] |
| 24.0 kbps [2] | ITU-T V.34[2] |
| 21.6 kbps [2] | ITU-T V.34[2] |
| 19.2 kbps [2] | ITU-T V.34[2] |
| 16.8 kbps [2] | ITU-T V.34[2] |
| 14.4 kbps | ITU-T V.34 or V.32bis |
| 12.0 kbps | ITU-T V.34 or V.32bis |
| 9600 bps | ITU-T V.34, V.32bis, or V.29 |
| 7200 bps | ITU-T V.34 or V.32bis |
| 4800 bps | ITU-T V.34 or V.32bis |
| 2400 bps | ITU-T V.34 or V.22bis |
| 1200 bps | ITU-T V.22bis, V.23, or Bell 212A |
| 300 bps | ITU-T V.21 |
| 300 bps | Bell 103 |

**Notes:**

1. Supported on CC-56K2 only
2. Supported on CC-56K2 and CC-33K2 only



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## Protocol Characteristics (Continued)

| Item | Specification |
|---|---|
| **Data Format** | |
| Bit synchronous | Selectable 8, 9, 10, or 11 bits per character |
| **Compatibility** | ITU-T V.90, V.34, V.32bis, V.32, V.23, V.22bis, V.22, V.21, Bell 212A, and Bell 103 |
| **Operating Mode** | |
| Switched network | Two-wire full duplex |
| **Data Modulation** | |
| 28 to 56 kbps[1] | V.90 as specified by ITU-T |
| 2.4 to 33.6 kpbs[2] | V.34 as specified by ITU-T |
| 14.4 kbps | 128-level TCM/2400 Baud ± 0.01% |
| 12.0 kbps | 64-level TCM/2400 Baud ± 0.01% |
| 9600 bps | 32-level TCM/2400 Baud ± 0.01% |
| 9600 bps | 16-level QAM/2400 Baud ± 0.01% |
| 9600 bps | V.29 QAM as specified by ITU-T |
| 7200 bps | 16-level TCM/2400 Baud ± 0.01% |
| 4800 bps | 4-level QAM/2400 Baud ± 0.01% |
| 2400 bps | 16-level QAM/600 Baud ± 0.01% |
| 1200 bps | 4-level PSK/600 Baud ± 0.01% |
| 0 to 300 bps | FSK 0-300 Baud ± 0.01% |
| **Answer Tone** | |
| ITU-T V.32bis, V.32, V.22bis, V.22, and V.21 modes | 2100 Hz ±3 Hz |
| Bell 212A and 103 modes | 2225 Hz ±3 Hz |
| **Transmit Carrier** | |
| V.90[1] | As specified by ITU-T |
| V.34[2] | As specified by ITU-T |
| ITU-T V.32bis | 1800 Hz ±0.01% |
| ITU-T V.22, V.22bis/Bell 212A | |
| Originate mode | 1200 Hz ±0.5 Hz |
| Answer mode | 2400 Hz ±1 Hz |
| ITU-T V.21 | |
| Originate mode | Mark (980 Hz ±12 Hz) Space (1180 Hz ± 12 Hz) |
| Answer mode | Mark (1650 Hz ± 12 Hz) Space (1850 Hz ±12 Hz) |
| Bell 103 | |
| Originate mode | Mark (1270 Hz ± 12 Hz) Space (1070 Hz ± 12 Hz) |
| Answer mode | Mark (2225 Hz ± 12 Hz) Space (2025 Hz ± 12 Hz) |
| **Output Level** | |
| Permissive-Switched network | -9 dBm maximum |
| **Notes:** | |
| **1**. Supported on CC-56K2 only. | |
| **2**. Supported on CC-56K2 and CC-33K2 only. | |



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## Protocol Characteristics (Continued)

| Item | Specifications |
|---|---|
| **Receive Carrier** | |
| ITU-T V.90[1] | As specified by ITU-T |
| ITU-T V.34[2] | As specified by ITU-T |
| ITU-T V.32bis | 1800 Hz ±7 Hz |
| ITU-T V.32 | 1800 Hz ±7 Hz |
| ITU-T V.22, V.22bis/Bell 212A | |
| Originate mode | 2400 Hz ±7 Hz |
| Answer mode | 2400 Hz ±7 Hz |
| ITU-T V.21 | |
| Originate mode | Mark (980 Hz ± 12 Hz) Space (1180 Hz ± 12 Hz) |
| Answer mode | Mark (1650 Hz ± 12 Hz) Space (1850 Hz ± 12 Hz) |
| Bell 103 | |
| Originate mode | Mark (2225 Hz ± 12 Hz) Space (2025 Hz ± 12 Hz) |
| Answer mode | Mark (1270 Hz ± 12 Hz) Space (1070 Hz ± 12 Hz) |
| Carrier Detect (level for ITU-T V.22bis, V.22, V.21, 212, 103) in Switched Network | Acquisition (-43 dBm) Release (-48 dBm) |
| Hysteresis | 2 dBm minimum |
| **Note:** ITU-T V.90[1], V.34[2], V.32/V.32bis are echo canceling protocols that use signal quality as criteria for maintaining connection. They also provide for self-training detection to forced disconnect | |
| DTE Interface | EIA/TIA-232-E (ITU-T V.24/V.28/ISO 2110) |
| Line Equalization | Automatic Adaptive |
| Connection Options | Loss of Carrier in ITU-T V.22bis and lower |
| Phone Types | 500 (rotary dial), 2500 (DTMF dial) |
| Dialing | Pulse and Tone |
| DTMF Output Level | Per Part 68 |
| Pulse Dial Ratio | Make/Break 39/61% |
| Ring Cadence | On 2 seconds; Off 4 seconds |
| Call Progress Monitor | BUSY, CONNECT (rate) NO ANSWER, NO CARRIER, NO DIALTONE, OK, RING, RINGING |
| **Notes:**<br>**1.** Supported on CC-56K2 only.<br>**2.** Supported on CC-56K2 and CC-33K2 only. | |



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# Functional Description

The World modem II is a complete embedded modem with integrated direct access arrangement (DAA) that provides a programmable line interface to meet global telephone line requirements. This solution includes a DSP data pump, modem controller, on-chip RAM and ROM, codec, DAA and analog output. The World Modem II accepts standard modem AT commands and provides connect rates up to 56/33.6/14.4 kbps full-duplex over the Public Switched Telephone Network (PSTN). The World modem II features a complete set of modem protocols including all ITU-T standard formats up to 56 kbps. The World modem II provides numerous additional features for embedded modem applications. The modem includes full type I and type II caller ID detection and decoding for global standards. Call progress is supported through echoing result codes and is also programmable to meet global settings. Because the World modem II integrates the DAA, analog features, such as parallel phone detect, overcurrent detection, and global PTT compliance with a single design, are included. This device is ideal for embedded modem applications due to its small board space, low power consumption, and global compliance. The silicon DAA can be programmed to meet worldwide PTT specifications for ac termination, dc termination, ringer impedance, and ringer threshold. In addition, the World modem II has been designed to meet the most stringent worldwide requirements for out-of-band energy, billing-tone immunity, surge immunity, and safety requirements. The World modem II allows for rapid integration into existing modem applications by providing a serial interface that can directly communicate to either a microcontroller via a UART interface or a PC via an RS-232. This interface allows for PC evaluation of the modem immediately upon powerup via the AT commands using standard terminal software.

## Host Interface

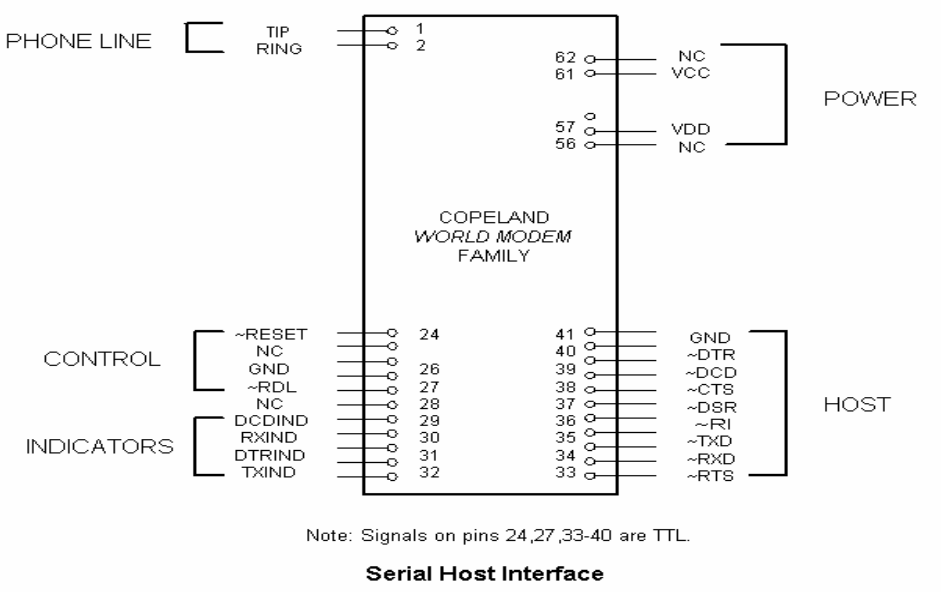
The host interface is serial TTL. The default host speed of 19.2 Kb and 8N1 format (8 data bits, no parity bit and 1 stop bit). The defaults can be changes after initialization by using standard AT commands. A true RS-232 interface is available on the World modem Evaluation Board.



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## Serial Interface

The pin out of the serial modem is shown in the figure below.




Note: Signals on pins 24,27,33-40 are TTL.

**Serial Host Interface**



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## Serial data

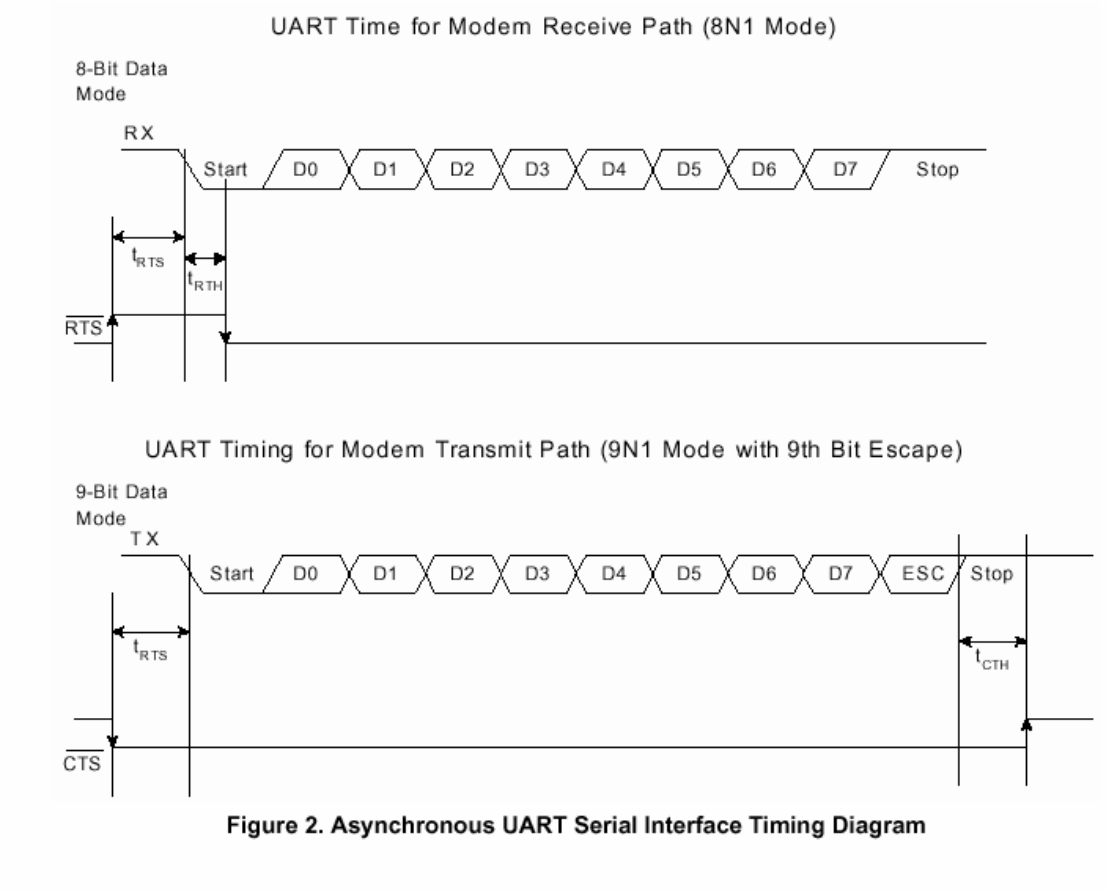



**Figure 2. Asynchronous UART Serial Interface Timing Diagram**

## Autobaud

The modem includes an automatic baud rate detection feature that allows the host to start transmitting data at any standard DTE rate from 300 bps to 307.2 kbps. This feature is enabled by default.

**Flow Control**

The modem provides both hardware and software flow control.

Hardware Flow Control

- RTS
- CTS
- DSR
- DTR



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**Status**

In addition to flow control, the modem provides two hardware status signals

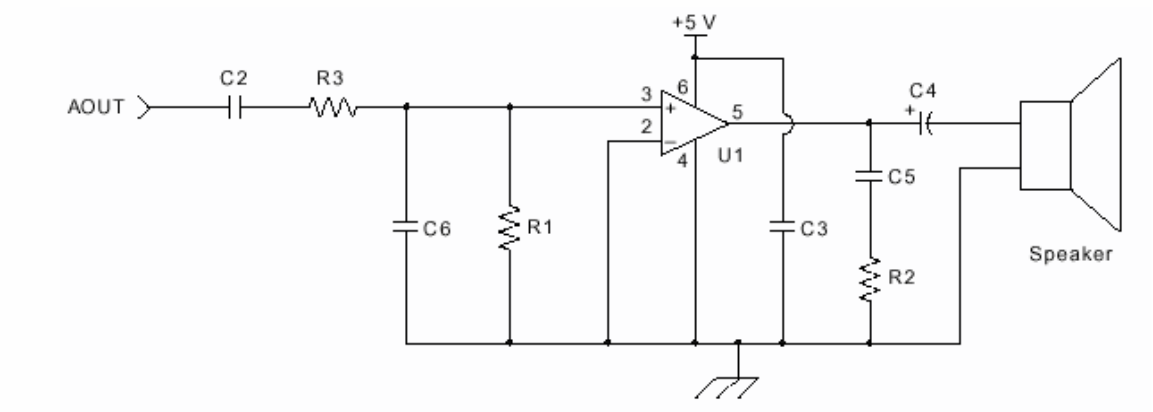
DCD
RI



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**Reset** – A hardware reset is provided to reset the modem controller on power-up or to force the modem back to its default settings. This active low signal has an on-board pull up. Leave this pin unconnected if hardware reset is not needed.

**Audio Output**
The World Modem II modules support an analog (audio) output. This analog signal can be used for call progress monitoring.




**Optional Call Progress Monitor**

**Suggested Component Values**

| Symbol | Value |
|---|---|
| C2, C3, C5 | 0.1 µF, 16 V, ±20% |
| C4 | 100 µF, 16 V, Elec. ±20% |
| C6 | 820 pF, 16 V, ±20% |
| R1 | 10 k?, 1/10 W, ±5% |
| R2 | 10 ?, 1/10 W, ±5% |
| R3 | 47 k?, 1/1 W, ±5% |
| U1 | LM386 |



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## Power

The module is powered by an external 3.3 VDC source. Pins 57 and 61 are tied together internally and either or both connected to an external 3.3V supply. There is no on-board regulation of the power supply. The system needs to supply approximately 50 mA of current.

The power pin(s) should be decoupled with a good quality 0.01 µF ceramic capacitor and a 1µF electrolytic or tantalum capacitor.

See CCI Common Socket Interface Specification for more details.



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## Basic AT Command Set (Command Defaults in Bold)

| Command | Action | |
|---|---|---|
| $ | Display AT command mode settings | |
| A | Answer incoming call | |
| A/ | Re-execute last command. This is the only command not preceded by "AT" or followed by a <CR> | |
| Dn | Dial, followed by 1 or more dial command modifiers, manually dials a phone number | |
| | **Modifier** | **Function** |
| | ! or & | Flash hook switch for FHT (U4F) ms (default: 500 ms) |
| | , or < | Pause before continuing for S8 seconds (default: 2 seconds) |
| | ; | Return to AT command mode |
| | @ | Wait for silence. |
| | G | Polarity reversal detect. By placing the "G" character in the dial string (i.e. ATDTG1), the modem will monitor the telephone line for polarity reversals. If a busy tone is detected, the modem will report "POLARITY REVERSAL" if a polarity reversal was detected or "NO POLARITY REVERSAL" if a polarity reversal was not detected. In each case, the result code is followed by "OK". If the S7 timeout occurs before a busy tone is detected, the modem will report "NO CARRIER". Polarity reversal monitoring begins after the last digit is dialed and ends when the busy tone is detected or S7 timeout occurs. |
| | L | Redial last number. |
| | P | Pulse (rotary) dialing) |
| | T | Tone (DTMF) dialing |
| | W | Wait for dial tone before continuing for S14 seconds (default: 12 seconds). Blind dialing modes X0, X1, and X3 do not affect the W command. If the DOP bit (U7A, bit 7) is set, the "ATDTW" command will cause the modem to pause dialing and either report an "OK" if a dial tone is detected or "NO DIALTONE" if a dial tone is not detected. |
| En | Local DTE echo | |
| E0 | Disable | |
| E1 | **Enable** | |
| Hn | Hook switch | |
| H0 | Go on-hook (hang up modem). | |
| H1 | Go off-hook. | |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| In | Identification and checksum. |
| I0 | Display World Modem chipset version.<br>B, C, D, E, F, G, H….etc. |
| I1 | Display World Modem firmware revision code (numeric). |
| I3 | Display line-side revision code. |
| I6 | Display chipset model number. |
| I7 | Diagnostic result 1. |
| I8 | Diagnostic result 2. |
| Mn | Speaker output (via AOUT pin 63) |
| **M0** | **Speaker is always off.** |
| M1 | Speaker is on during dialing and handshaking. Off in data mode. |
| M2 | Speaker is always on. |
| M3 | Speaker is off while dialing. On during handshake and retrianing. |
| On | Return to data mode from command mode operation. |
| O0 | Return to data mode. |
| O1 | Return to data mode and perform a full retrain (except for 300 bps). |
| O2 | Return to data mode and perform rate renegotiation. |
| Qn | Response mode. |
| **Q0** | **Enable result codes.** |
| Q1 | Disable result codes. |
| R | Initiate V.23 reversal. |
| Sn | S-register operation. |
| S$ | List contents of all S-registers. |
| Sn? | Displays contents of S-register n. |
| Sn=x | Set S-register n to value x. (x and n are decimal numbers). |
| Vn | Result code type. |
| V0 | Numeric result codes. |
| **V1** | **Verbal Result codes.** |
| Xn | Call Progress Monitor (CPM). Controls which CPM signals are monitored and reported to the host from the modem. |
| X0 | Basic results. Disable CPM, blind dial (doesn't wait for dial tone). CONNECT message does not include speed. |
| X1 | Extended results. Disable CPM, blind dial. Connect message includes speed. |
| X2 | Extended results and detect dial tone only. |
| X3 | Extended results and detect busy only. |
| **X4** | **Extended results and full CPM enabled. CONNECT message includes speed.** |
| X5 | Extended results. Full CPM and ringback detection enabled. |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| Yn | Long space disconnect. Modem hangs up after 1.5 seconds or more of continuous space while on-line. |
| **Y0** | **Disable.** |
| Y1 | Enable. |
| Z | Hard Reset - Resets the modem. (Same as asserting RESET# on pin 24). |
| :E | Read from serial EEPROM. |
| :I | Interrupt read. This command causes the modem to report the lower 8 bits of the interrupt register IO Control 0 (U70). The CID, OCD, PPD, and RI bits are also cleared. |
| :M | Write to Serial EEPROM. |
| :P | Program RAM write. This command is used to upload firmware supplied by CCI to the modem. Contact CCI for more information. |
| :R | User-Access Register Read. This command allows the user to read from us er-access registers. The format is "AT:Raa", where:<br>aa = user-access address in hexadecimal.<br>"AT:R" command causes all the U-registers to be displayed. |
| :U | User-Access Register Write. Allows the user to write to the 16-bit user-access registers. The format is "AT:Uaa,xxxx,yyyy,zzzz" where<br>aa = user-access address in hexadecimal.<br>xxxx = data in hexadecimal to be written to location aa.<br>yyyy = data in hexadecimal to be written to location (aa + 1).<br>zzzz = data in hexadecimal to be written to location (aa + 2). |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +DR=X | Data Compression Reporting.<br>**X Mode**<br>**0 Disabled**<br>1 Enabled<br>If enabled, the intermediate result code is transmitted at the point after error control negotiation. The format of the result code is:<br>**Result Code Mode**<br>+DR:NONE Data compression is not in use.<br>+DR:V42B Rec V.42bis is in use in both directions.<br>+DR:V42B RD Rec V.42bis is in use in receive direction only.<br>+DR:V42B TD Rec V.42bis is in use in transmit direction only. |
| +DS Options<br>+DS = A<br>+DS=A,B<br>+DS=A,B,C<br>+DS=A,B,C,D | Controls V.42bis data compression function.<br>A Direction<br>0 No compression<br>1 Transmit only<br>2 Receive only<br>3 Both Directions<br>B Compression Negotiation<br>**0 Do not disconnect if V.42 is not negotiated.**<br>1 Disconnect if V.42 is not negotiated.<br>C Maximum dictionary size<br>512<br>D Maximum string size<br>6 to 250 (28 default) |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +ES Options<br>+ES = A<br>+ES = A,,C | Enable synchronous assess mode.<br>A Specifies the mode of operation when initiating a modem connection.<br>D Disable synchronous access mode.<br>6 Enable synchronous access mode when connection is completed and data state is entered<br>C Specifies the mode of operation when answering a modem connection.<br>D Disable synchronous access mode<br>8 Enable synchronous access mode when connection is completed and data state is entered. |
| +ESA Options<br>+ESA = A<br>+ESA = A,B<br><br>+ESA = A,B,C<br>+ESA = A,B,C,E<br><br>+ESA = A,B,C,E,F<br>+ESA = A,B,C,E,F,G | Synchronous access mode control options.<br>A Specifies action taken if an underrun condition occurs during transparent sub-mode.<br>0 Modem transmits 8-bit SYN sequences on idle.<br>B Specifies action taken if an underrun condition occurs after a flag during framed sub-mode.<br>0 Modem transmits 8-bit HDLC flags on idle.<br>C Specifies action taken if an underrun or overrun condition occurs after a non-flag during framed sub-mode.<br>0 Modem transmits abort on underrun in middle of frame.<br>1 Modem transmits flag on underrun in middle of frame and notifies host of underrun or overrun.<br>D Specifies V.34 half duplex operation.<br>This parameter should not be used.<br>E Specifies CRC polynomial used while in framed sub-mode<br>0 CRC generation checking disable.<br>1 16-bit CRC generation and checking is performed by the modem.<br>F Specifies NRZI encoding and decoding.<br>0 NRZI encoding and decoding disabled.<br>G Specifies SYN.<br>255 |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +FCLASS = X | Class 1 Mode Enable for V.29 fast connect.<br>X Mode<br>**0 Off**<br>1 Enables support for Class 1 mode for use in the V.29 fast connect mode. |
| +FRM = X | Class 1 Receive Carrier for V.29 fast connect.<br>X Mode<br>2 Transmit V.21 (980 Hz) tone for longer than 100 ms, then send answer tone (2100/2225 Hz) for 200 ms.<br>95 V.29 short synchronous.<br>96 V.29 full synchronous. |
| +FTM = X | Class 1 Transmit Carrier for V.29 fast connect.<br>X Mode<br>4 Transmit V.21 (890 Hz) tone.<br>53 Same as &T4, but transmit V.29 7200 bps. Data pattern set by S40 register. AT+ FCLASS = 0 must be sent to restore the modem to normal operation after test.<br>54 Same as &T4, but transmit V.29 9600 bps. Data pattern set by S40 register. AT + FCLASS = 0 must be sent to restore the modem to normal operation after test.<br>95 V.29 short synchronous.<br>96 V.29 full synchronous. |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +GCI = X | Country Settings - Automatically configure all registers for a particular country.<br>X Country<br>0 Japan<br>9 Australia<br>A Austria<br>F Belgium<br>16 Brazil<br>1B Bulgaria<br>20 Canada<br>26 China<br>27 Columbia<br>2E Czech Republic<br>31 Denmark<br>35 Ecuador<br>3C Finland<br>3D France<br>42 Germany<br>46 Greece<br>50 Hong Kong<br>51 Hungary<br>53 India<br>57 Ireland<br>58 Israel<br>59 Italy<br>61 South Korea<br>69 Luxembourg<br>6C Malaysia<br>73 Mexico<br>7B Netherlands<br>7E New Zealand |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +GCI = X (cont) | 82 Norway<br>87 Paraguay<br>89 Philippines<br>8A Poland<br>8B Portugal<br>9C Singapore<br>9F South Africa<br>A0 Spain<br>A5 Sweden<br>A6 Switzerland<br>B4 United Kingdom<br>**B5 United States**<br>B8 Russia<br>FE Taiwan<br>**Note:** U-Registers are configured to recommended values. The +GCI command resets the U-registers and the S6 and S7 S-registers to default values before setting country specific values. Changes may be made to individual registers after setting the AT+GCI command. |
| +GCI? | List current country code setting. (response: +GCI:<settings>). |
| +GCI = ? | Lists all possible country code settings. |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +IFC Options<br>+IFC = A<br>+IFC = A,B | Specifies the flow control to be implemented.<br>A Specifies the flow control method used by the host to control data from the modem.<br>0 None<br>1 Local XON/OFF flow control. Does not pass XON/XOFF character to the remot modem.<br>2 Hardware flow control (RTS).<br>B Specifies the flow control method used by the modem to control data from the host.<br>0 None<br>1 Local XON/OFF flow control. Does not pass XON/XOFF character to the remot modem.<br>2 Hardware flow control (CTS). |
| +ITF Options<br>+ITF = A<br>+ITF = A,B<br>+ITF = A,B,C | Transmit flow control threshold.<br>A Threshold above which the modem will generate a flow off signal.<br>< 0 to 511> bytes<br>B Threshold below which the modem will generate a flow on signal<br>< 0 to 511> bytes<br>C Polling interval for <EM><BNUM> indicator<br>0 to 300 in 10 msec units. |
| +MR = X | Modulation reporting control.<br>X Mode<br>**0 Disabled**<br>1 Enabled<br>If enabled, the intermediate result code is transmitted at the point during connect negotiation. The format of this result code is asw follows:<br>+MCR: <carrier> e.g. +MCR: V32B<br>+MRR: <rate> e.g. +MRR: 14400 |
| +MS Options<br>+MS = A<br>+MS = A,B<br>+MS = A,B,C<br>+MS = A,B,C,D<br>+MS = A,B,C,D,E<br>+MS = A,B,C,D,E,F | Modulation Selection.<br>A Preferred modem carrier<br>V21 ITU-T V.21<br>V22 ITU-T V.22<br>V.22B ITU-T V.22bis<br>**V32 ITU-T V.32 (default for CC-14.4K2)**<br>V.32B ITU-T V.32bis<br>**V34 ITU-T V.34 (default for CC-33K2)**<br>**V90 ITU-T V.90 (default for CC-56K2)**<br>B Automatic modulation negotiation<br>0 Disabled<br>**1 Enabled**<br>C,D Min rate/Min rx rate are optional numeric values that specify the lowest value at which the DCE ma establish a connection. If unspecified (set to zero), the are determined by the carrier and automode settings.<br>E,F Max rate/Max rx rate are optional numeric values which specify the highest values which specify the highest value at which the DCE may establish a connection. If unspecified (set to 0), they are determined by the carrier and automode settings. |



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## Basic AT Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| +PCW = X | Controls the action to be taken upon detection of call waiting.<br>X Mode<br>0 Toggle RI# and collect Type II Caller ID if enabled by +VCID.<br>1 Hang up.<br>**2 Ignore Call Waiting.** |
| +VCDT = X | Caller ID Type.<br>X Mode<br>**0 After ring only.**<br>1 Always on.<br>2 UK<br>3 Japan |
| +VCID = X | Caller ID Enable.<br>X Mode<br>**0 Off**<br>1 On - formatted<br>2 On - raw data format |
| +VCDIR? | Type II Caller ID information - The modem will display "+VCDIR:" followed by raw caller ID information including checksum. |



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## Extended AT& Command Set (Command Defaults in Bold)

| Command | Action |
|---|---|
| &$ | Display AT& current settings |
| &F | Restore factory default settings |
| &Gn | Line connection rate limit. This command sets the upper limit on line speed that the modem can connect. The &Hn may limit the line speed as well. |
| &G3 | 1200 bps max |
| &G4 | 2400 bps max |
| &G5 | 4.8 kbps max |
| &G6 | 7.2 kbps max |
| &G7 | 9.6 kbps max |
| &G8 | 12 kbps max |
| **&G9** | **14.4 kbps max (default for CC-14.4K)** |
| &G10 | 16.8 kbps max |
| &G11 | 19.2 kbps max |
| &G12 | 21.6 kbps max |
| &G13 | 24 kbps max |
| &G14 | 26.4 kbps max |
| &G15 | 28.8 kbps max |
| &G16 | 31.2 kbps max |
| **&G17** | **33.6 kbps max (default for CC-33K and CC-56K2)** |
| &Hn | Switched network handshake mode. &Hn must be on separate command line from ATD, ATA, ATO commands. |
| **&H0** | **V.90 with automatic fallback (56 kbps to 300 bps) (default for CC-56K2)** |
| &H1 | V.90 only (56 kbps to 28 kbps) |
| **&H2** | **V.34 with automatic fallback (33.6 kbps to 300 bps) ( default for CC-33K2)** |
| &H3 | V.34 only (33.6 kbps to 2400 bps) |
| **&H4** | **ITU-T V.32bis with automatic fallback (14.4 kbps to 300 bps) (default for CC-14.4K2)** |
| &H5 | ITU-T V.32bis only (14.4 kbps to 4800 bps) |
| &H6 | ITU-T V.22bis only (2400 bps to 1200 bps) |



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## Extended AT& Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| &H7 | ITU-T V.22 only (1200 bps) |
| &H8 | Bell 212 only (1200 bps) |
| &H9 | Bell 103 only (300 bps) |
| &H10 | ITU-T V.21 only (300 bps) |
| &H11 | V.23 (1200/75 bps) |
| &Pn | Japan pulse dialing |
| &P0 | Configure modem for 10 pulse-per-second pulse dialing (Japan) |
| &P1 | Configure modem for 20 pulse-per-second pulse dialing (Japan) |
| &Tn | Test mode |
| &T0 | Cancel test mode (Escape to command mode to issue AT&T0). This command will also report the number of bit errors encountered on the previous &T4 test. |
| &T2 | Initiate ITU-T V.54 (ANALOOP) test. Modulation set by &H AT command. Test loop is through the DSP (CC-14.4K2/CC-33K2/CC-56K2 only). The modem echoes data from TX pin back to RX pin. |
| &T3 | Initiate ITU-T V.54 (ANALOOP) test. Modulation set by &H AT command. Test loop is through the DSP, DAA interface section, DAA interface and analog hybrid circuit. The modem echoes data from TX pin back to RX pin. |
| &T4 | Initiate transmit as originating modem with automatic data generation. Modulation, data rate and symbol rate are set by &H, &G and S41. Data pattern is set by the S40 register. Continues until the ATH command is sent after an escape into command mode.<br>Data is also demodulated as in ANALOOP, and any bit errors are counted to be displayed after the test using &T0. |
| &T5 | Initiate transmit as answering modem with automatic data generation. Modulation, data rate, and symbol rate are set by &H, &G and S41. Data pattern is set by the S40 register. Continues until ATH command is sent after escape into command mode.<br>Data is also demodulated as in ANALOOP, and any bit errors are counted to be displayed after the test using &T0. |
| &T6 | Compute checksum for firmware-upgradeable section of program memory. If no firmware upgrade is installed, &T6 returns 0x0408. |
| &Xn | Automatic determination of telephone line type. |
| &X0 | Abort &x1 or &x2 command |



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## Extended AT& Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| &X1 | Automatic determination of telephone line type.<br>Result code: WXYZn<br>W: 0 = line supports DTMF dialing.<br>1 = line is pulse dial only.<br>X: 0 = line supports 20 pps dialing.<br>1 = line supports 10 pps dialing only.<br>Y: 0 = extension network present (PBX).<br>1 = outside line (PSTN) connected directly.<br>Z: 0 = continuous dialtone<br>1 = make-break dialtone.<br>n: 0-9 (number required for outside line if Y = 0) |
| &X2 | Same as &X1, but Y result (PBX) is not tested. |
| *Y2A | Produce a constant answer tone (ITU-T) and return to command mode. The answer tone continues until the ATH command is received or the S7 timer expires. |
| &Z | Enter Low power wake-up on ring. |



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## Extended AT% Command Set (Command Defaults in Bold)

| Command | Action |
|---|---|
| %$ | Display AT% command settings. |
| %B | Report blacklist. See also S42 register. |
| %Cn | Data compression |
| %C0 | Disable V.42bis and MNP5 data compression |
| **%C1** | **Enable V.42bis in transmit and receive paths. If MNP is selected (\N2), then %C1 enables MNP5 in transmit and receive paths.** |
| %C2 | Enable V.42bis in transmit path only. |
| %C3 | Enable V.42bis in receive path only. |
| %On | Answer mode |
| **%O1** | **Modem will auto-answer a call in answer mode.** |
| %O2 | Modem will auto-answer a call in originate mode. |
| %Vn | Automatic Line Status Detection<br>After the %V1 and %V2 commands are issued, the modem will automatically check the telephone connection for weather or not a line is present. If a line is present, the modem will automatically check if the line is already in use.<br>Finally, the modem will check line status both before going off-hook and again before dialing. %V1 uses the fixed method, and %V2 uses the adaptive method. %V0 (default) disables this feature. |
| **%V0** | **Disable automatic line-in-use detection.** |
| &V1 | Automatic Line Status Detection - Fixed Method.<br>Description: Before going off-hook with the ATD, ATO or ATA commands the modem compares the line voltage via LVCS to registers NOLN (U83) and LIUS (U84):<br>**Loop Voltage** — **Action**<br>0 <= LVCS <= NOLN — Report "NO LINE" and remain on-hook.<br>NOLN <= LVCS <= LIUS — Report "LINE IN USE" and remain on-hook.<br>LIUS <= LCVS — Go off-hook and establish a modem connection.<br>One the call has begun, the off-hook intrusion algorithm operates normally.<br>In addition, the modem will report "NO LINE" if the telephone line is completely disconnected.<br>If the HOI bit (U77, bit11) is set, "LINE IN USE" is reported upon intrusion. |
| &V2 | Automatic Line Status Detection - Adaptive Method.<br>Description: Before going off-hook with the ATD, ATO or ATA commands, the modem compares the line voltage (via LVCS to the NLIU (U85) register:<br>**Loop Voltage** — **Action**<br>0 <- LVCS <= (0.0625 x NLIU) — Report "NO LINE" and remain on-hook.<br>(0.0625 x NLIU) < LVCS <= (0.85 x NLIU) — Report "LINE IN USE" and remain on-hook.<br>(0.85 x NLIU) < LCVS — Go off-hook and establish a moden connection. |



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## Extended AT\ Command Set (Command Defaults in Bold)

| Command | Action |
|---|---|
| \$ | Display AT\ command settings. |
| \Bn | Character length will be automatically set in autobaud mode. |
| \B0 | 6N1 - six data bits, no parity, one stop bit, one start bit, eight bits total (\N0 only)[1] |
| \B1 | 7N1 - seven data bits, no parity, one stop bit, one start bit, nine bits total (\N0 only)[1] |
| \B2 | 7P1 - seven data bits, parity options by \P, one stop bit, one start bit, 10 bits total. |
| **\B3** | **8N1 - eight data bits, no parity, one stop bit, one start bit, 10 bits total.** |
| \B5 | 8P1 - eight data bits, parity optioned by \P, one stop bit, one start bit, 11 bits total (\N0 only). |
| \B6 | 8X1 - eight data bits, one escape bit, one stop bit, one start bit, 11 bits total (enables ninth-bit escape mode). |
| \Nn | Asynchronous protocol. |
| \N0 | Wire mode (no error correction, no compression). |
| \N2 | MNP reliable mode. The modem attempts to connect with the MNP protocol. If unsuccessful, the call is dropped. |
| **\N3** | **V.42 auto-reliable - The modem attempts to connect with the V.42 protocol. If unsuccessful, the MNP protocol is attempted. If unsuccessful, wire mode is attempted.** |
| \N4 | V.42 (LAPM) reliable mode (or drop call) - Same as \N3 except that the modem drops the call instead of connecting in MNP or wire mode. |
| \N5 | V.42 and MNP reliable mode - The modem attempts to connect with V.42. If un successful, MNP is attempted. If MNP is unsuccessful, the call is dropped. |
| \Pn | Parity type will be automatically set in autobaud mode. |
| **\P0** | **Even** |
| \P1 | Space[1] |
| \P2 | Odd |
| \P3 | Mark[1] |
| \Qn | Modem-to-DTE flow control. |
| \Q0 | Disable all flow control - This may only be used if the DTE speed and the VF speed are guaranteed to match throughout the call. |
| **\Q2** | **Use CTS only.** |
| \Q3 | Use RTS/CTS |
| \Q4 | Use XON/XOFF flow control for modem-to-DTE interface. Does not enable modem-to-modem flow control. |



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## Extended AT\ Command Set (Command Defaults in Bold) (Continued)

| Command | Action |
|---|---|
| \Tn | DTE rate - Change DTE rate. When the modem is configured in autobaud mode (default), \T0 through \T15 will lock the new baud rate and disable autobaud. |
| \T0 | 300 bps |
| \T1 | 600 bps |
| \T2 | 1200 bps |
| \T3 | 2400 bps |
| \T4 | 4800 bps |
| \T5 | 7200 bps |
| \T6 | 9600 bps |
| \T7 | 12.0 kbps [2] |
| \T8 | 14.4 kbps |
| \T9 | 19.2 kbps [3] |
| \T10 | 38.4 kbps |
| \T11 | 57.6 kbps |
| \T12 | 115.2 kbps |
| \T13 | 230.4 kbps |
| \T14 | 245.760 kbps [2] |
| \T15 | 307.200 kbps |
| **\T16** | **Autobaud on[3]** |
| \T17 | Autobaud off; locked at current baud rate. |
| \U | Causes a low pulse (25 ms) on RI and DCD. INT to be the inverse of ESC. RTS to be inverse of CTS. This command terminates with a RESET. |
| \Vn | Connect message type. |
| **\V0** | **Report connect message and protocol message.** |
| \V2 | Report connect message only (exclude protocol message). |
| \V4 | Report connect and protocol message with both upstream nad downstream connect rates. |

**Notes:**

1. When in autobaud mode, \B0, \B1, and \P1 will not be detected automatically. The combination of \B2 and \P3 will be detected. This is compatible with 7N2. 7N1 may be forced by sending AT\T17\B1.
2. The autobaud feature does not detect this rate.
3. Default is \T16. \T9 may be defaulted as an order option. Contact the factory for details



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## Result Codes

| Numeric | Meaning | Verbal Response | X0 | X1 | X2 | X3 | X4 | X5 |
|---|---|---|---|---|---|---|---|---|
| 0 | Command was successful | OK | X | X | X | X | X | X |
| 1 | Link established at 300 bps or higher | CONNECT | X | X | X | X | X | X |
| 2 | Incoming ring detected | RING | X | X | X | X | X | X |
| 3 | Link dropped | NO CARRIER | X | X | X | X | X | X |
| 4 | Command failed | ERROR | X | X | X | X | X | X |
| 5 | Link established at 1200 | CONNECT 1200 | | X | X | X | X | X |
| 6 | Dial tone not present | NO DIALTONE | | | X | | X | X |
| 7 | Line busy | BUSY | | | | X | X | X |
| 8 | Remote not answering | NO ANSWER | X | X | X | X | X | X |
| 9 | Ringback detected | RINGING | | | | | | X |
| 10 | Link established at 2400 | CONNECT 2400 | | X | X | X | X | X |
| 11 | Link established at 4800 | CONNECT 4800 | | X | X | X | X | X |
| 12 | Link established at 9600 | CONNECT 9600 | | X | X | X | X | X |
| 14 | Link established at 19200 | CONNECT 19200[1] | | X | X | X | X | X |
| 15 | Link established at 7200 | CONNECT 7200 | | X | X | X | X | X |
| 16 | Link established at 12000 | CONNECT 12000 | | X | X | X | X | X |
| 17 | Link established at 14400 | CONNECT 14400 | | X | X | X | X | X |
| 18 | Link established at 16800 | CONNECT 16800[1] | | X | X | X | X | X |
| 19 | Link established at 21600 | CONNECT 21600[1] | | X | X | X | X | X |
| 20 | Link established at 24000 | CONNECT 24000[1] | | X | X | X | X | X |
| 21 | Link established at 26400 | CONNECT 26400[1] | | X | X | X | X | X |
| 22 | Link established at 28800 | CONNECT 28800[1] | | X | X | X | X | X |
| 23 | Link established at 31200 | CONNECT 31200[1] | | X | X | X | X | X |
| 24 | Link established at 33600 | CONNECT 33600[1] | | X | X | X | X | X |
| 30 | Caller ID mark detected | CIDM | X | X | X | X | X | X |
| 31 | Hookswitch flash detected | FLASH | X | X | X | X | X | X |
| 32 | UK CID State Tone Alert Signal detected | STAS | X | X | X | X | X | X |
| 33 | Overcurrent condition | X[2] | X | X | X | X | X | X |
| 40 | Blacklist is full | BLACKLIST FULL (enabled via S42 register) | X | X | X | X | X | X |
| 41 | Attempted number is blacklisted | BLACKLISTED (enabled via S42 register) | X | X | X | X | X | X |
| 42 | No phone line present | NO LINE (enabled via %Vn commands) | X | X | X | X | X | X |

**Notes:**

1. When in autobaud mode, \B0, \B1, and \P1 will not be detected automatically. The combination of \B2 and \P3 will be detected. This is compatible with 7N2. 7N1 may be forced by sending AT\T17\B1.
2. The autobaud feature does not detect this rate.
3. Default is \T16. \T9 may be defaulted as an order option. Contact the factory for details



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## Result Codes (Continued)

| Numeric | Meaning | Verbal Response | X0 | X1 | X2 | X3 | X4 | X5 |
|---|---|---|---|---|---|---|---|---|
| 43 | Telephone line is in use | LINE IN USE | X | X | X | X | X | X |
| 44 | A polarity reversal detected | POLARITY REVERSAL | X | X | X | X | X | X |
| 45 | A reversal NOT detected | NO POLARITY REVERSAL | X | X | X | X | X | X |
| 52 | Link established at 56000 | CONNECT 56000[3] | | X | X | X | X | X |
| 60 | Link established at 32000 | CONNECT 32000[3] | | X | X | X | X | X |
| 61 | Link establis hed at 48000 | CONNECT 48000[3] | | X | X | X | X | X |
| 63 | Link established at 28000 | CONNECT 28000[3] | | X | X | X | X | X |
| 64 | Link established at 29333 | CONNECT 29333[3] | | X | X | X | X | X |
| 65 | Link established at 30666 | CONNECT 30666[3] | | X | X | X | X | X |
| 66 | Link established at 33333 | CONNECT 33333[3] | | X | X | X | X | X |
| 67 | Link established at 34666 | CONNECT 34666[3] | | X | X | X | X | X |
| 68 | Link established at 36000 | CONNECT 36000[3] | | X | X | X | X | X |
| 69 | Link established at 37333 | CONNECT 37333[3] | | X | X | X | X | X |
| 70 | No protocol | PROTOCOL: NONE | Set with \V0 command | | | | | |
| 75 | Link established at 75 | CONNECT 75 | | X | X | X | X | X |
| 77 | V.42 protocol | PROTOCOL: V42 | Set with \V0 command | | | | | |
| 79 | V.42bis protocol | PROTOCOL: V42bis | Set with \V0 command | | | | | |
| 80 | MN P2 protocol | PROTOCOL: ALTERNATE, + CLASS 2 | Set with \V command | | | | | |
| 81 | MNP3 protocol | PROTOCOL: ALTERNATE, + CLASS 3 | Set with \V command | | | | | |
| 82 | MNP4 protocol | PROTOCOL: ALTERNATE, + CLASS 4 | Set with \V command | | | | | |
| 83 | MNP5 protocol | PROTOCOL: ALTERNATE, + CLASS 5 | Set with \V command | | | | | |
| 90 | Link established at 38666 | CONNECT 38666[3] | | X | X | X | X | X |
| 91 | Link established at 40000 | CONNECT 40000[3] | | X | X | X | X | X |
| 92 | Link established at 41333 | CONNECT 41333[3] | | X | X | X | X | X |
| 93 | Link established at 42666 | CONNECT 42666[3] | | X | X | X | X | X |
| 94 | Link established at 44000 | CONNECT 44000[3] | | X | X | X | X | X |
| 95 | Link established at 45333 | CONNECT 45333[3] | | X | X | X | X | X |
| 96 | Link established at 46666 | CONNECT 46666[3] | | X | X | X | X | X |
| 97 | Link established at 49333 | CONNECT 49333[3] | | X | X | X | X | X |
| 98 | Link established at 50666 | CONNECT 50666[3] | | X | X | X | X | X |
| 99 | Link established at 52000 | CONNECT 52000[3] | | X | X | X | X | X |
| 100 | Link established at 53333 | CONNECT 53333[3] | | X | X | X | X | X |
| 101 | Link established at 54666 | CONNECT 54666[3] | | X | X | X | X | X |
| 102 | DTMF dial attempt on pulse dial only line | UN-OBTAINABLE NUMBER | X | X | X | X | X | X |

1. This message only supported on CC-56K2 and CC-33K2
2. X is the only verbal response code that does not follow the <CR><LF> Result Code<CRF><LF> standard. There is no leading <CR><LF>
3. This message is only supported on the CC-56K2



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## S-Registers

The S command allows reading (Sn?) or writing (Sn = x) the S-registers. The S-registers store values for functions that typically are rarely changed, such as timers or counters, and the ASCII values of control characters such as carriage return. The following table summarizes the S-register set.



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## S Register Definition

| S-Register (Decimal) | Function | Default (Decimal) | Range | Units |
|---|---|---|---|---|
| 0 | Automatic answer - Number of rings the modem must detect before answering a call. 0 disables auto answer. | 0 | 0 - 255 | Rings |
| 1 | Ring counter. | 0 | 0 - 255 | Rings |
| 2 | ESC code character. | 43 (+) | 0 - 255 | ASCII |
| 3 | Carriage return character. | 13 (CR) | 0 - 255 | ASCII |
| 4 | Linefeed character. | 10 (LF) | 0 - 255 | ASCII |
| 5 | Backspace character. | 08 (BS) | 0 - 255 | ASCII |
| 6 | Dial tone wait timer - Number of seconds the modem waits before blind dialing. Only applicable if blind dialing is enabled (X0, X1, X3). | 02 | 0 - 255 | seconds |
| 7 | Carrier wait timer - Number of seconds the modem waits for carrier before timing out. This register also sets the number of seconds the modem waits for ring-back when originating a call before hanging up.<br>This register also sets the number of seconds the answer tone will continue while using the AT*Y2A command. | 80 | 0 - 255 | seconds |
| 8 | Dial pause timer for , and < dial command modifiers. | 02 | 0 - 255 | seconds |
| 9 | Carrier presence timer - Time after a loss of carrier that a carrier must be detected before reactivating DCD. S9 is referred to as "carrier loss debounce time". | 06 | 1 - 255 | 0.1 second |
| 10 | Carrier loss timer - Time the carrier must be lost before the modem disconnects. Setting 255 disables disconnect entirely. If S10 is less than S9, even a momentary loss of carrier causes a disconnect. | 14 | 1 - 255 | 0.1 second |
| 12 | Escape code guard timer - Minimum guard time required before and after "+++" for the modem to recognize a valid escape sequence. | 50 | 1 - 255 | 0.02 second |
| 14 | Wait for dial tone delay value (in relation to the W dial modifier). Starts when "W" is executed in the dial string. | 12 | 0 - 255 | seconds |



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## S-Register Description (Continued)

| S-Register (Decimal) | Function | Default (Decimal) | Range | Units |
|---|---|---|---|---|
| 42 | Blacklisting - The modem will not dial the same number fore than two times in three minutes. An attempt to dial a 3rd time will result in a "BLACKLISTED" result code.<br>If the blacklist memory is full, any dial to a new number will result in a "BLACKLIST FULL" result code. Numbers are added to the blacklist only if the modem connection fails. The %B command will list the numbers on the blacklists<br>0 = disabled<br>**1 = enabled** | 0 (disabled) | 0-1 | |
| 43 | Dial attempts to blacklist. When blacklisting is enabled with S42, this value controls the number of dial attempts that will result in a number being blacklisted. | 4 | 0-4 | - |
| 44 | Blacklist Timer. Period during which blacklisting is active | 180 | 0-255 | seconds |
| 50 | Minimum on-hook time - The modem will remain on-hook for S50 seconds. Any attempt to go off-hook will be delayed until this timer expires. | 3 | 0 - 255 | seconds |
| 51 | Number to start checking for an outside line on a PBX. | 1 | 0 - 9 | - |



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## User-Access Registers (U-Registers)

The :U AT command is used to write these 16-bit U-Registers and the :R command is used to read them. U-registers are identified by a hexadecimal (hex) address.

| Register | Name | Description | Default |
|---|---|---|---|
| U00 | DT1A0 | DT1 registers set the coefficients for stage 1 of the Dial Tone Detect filter. Default is for FCC countries. | 0x0800 |
| U01 | DT1B1 | | 0x0000 |
| U02 | DT1B2 | | 0x0000 |
| U03 | DT1A2 | | 0x0000 |
| U04 | DT1A1 | | 0x0000 |
| U05 | DT2A0 | Dial tone detect filters stage 2 biquad coefficients. | 0x00A0 |
| U06 | DT2B1 | | 0x6EF1 |
| U07 | DT2B2 | | 0xC4F4 |
| U08 | DT2A2 | | 0xC000 |
| U09 | DT2A1 | | 0x0000 |
| U0A | DT3A0 | Dial tone detect filters stage 3 biquad coefficients. | 0x00A0 |
| U0B | DT3B1 | | 0x78B0 |
| U0C | DT3B2 | | 0xC305 |
| U0D | DT3A2 | | 0x4000 |
| U0E | DT3A1 | | 0xB50A |
| U0F | DT4A0 | Dial tone detect filters stage 4 biquad coefficients. | 0x0400 |
| U10 | DT4B1 | | 0x70D2 |
| U11 | DT4B2 | | 0xC830 |
| U12 | DT4A2 | | 0x4000 |
| U13 | DT4A1 | | 0x80E2 |
| U14 | DTK | Dial tone detect filter output scalar. | 0x0009 |
| U15 | DTON | Dial tone detect ON threshold. | 0x00A0 |
| U16 | DTOF | Dial tone detect OFF threshold. | 0x0070 |



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## User-Access Registers (continued)

| Register | Name | Description | Default |
|---|---|---|---|
| U17 | BT1A0 | BT1 registers set the coefficients fo stage 1 of the Busy Tone Detect filter. Default is for FCC countries. | 0x0800 |
| U18 | BT1B1 | | 0x0000 |
| U19 | BT1B2 | | 0x0000 |
| U1A | BT1A2 | | 0x0000 |
| U1B | BT1A1 | | 0x0000 |
| U1C | BT2A0 | Busy tone detect filter stage 2 biquad coefficients. | 0x00A0 |
| U1D | BT2B1 | | 0x6EF1 |
| U1E | BT2B2 | | 0xC4F4 |
| U1F | BT2A2 | | 0xC000 |
| U20 | BT2A1 | | 0x0000 |
| U21 | BT3A0 | Busy tone detect filter stage 3 biquad coefficients. | 0x00A0 |
| U22 | BT3B1 | | 0x78B0 |
| U23 | BT3B2 | | 0xC305 |
| U24 | BT3A2 | | 0x4000 |
| U25 | BT3A1 | | 0xB50A |
| U26 | BT4A0 | Busy tone detect filter stage 4 biquad coefficients. | 0x0400 |
| U27 | BT4B1 | | 0x70D2 |
| U28 | BT4B2 | | 0xC830 |
| U29 | BT4A2 | | 0x4000 |
| U2A | BT4A1 | | 0x80E2 |
| U2B | BTK | Busy tone detect filter output scalar. | 0x0009 |
| U2C | BTON | Busy tone detect ON threshold. | 0x00A0 |
| U2D | BTOF | Busy tone detect OFF threshold. | 0x0070 |
| U2E | BMTT | Busy cadence minimum total time in seconds multiplied by 7200. | 0x0870 |
| U2F | BDLT | Busy cadence delta in seconds multiplied by 7200. | 0x25F8 |
| U30 | BMOT | Busy cadence minimum on time in seconds multiplied by 7200. | 0x0438 |
| U31 | RMTT | Ringback cadence minimum total time in seconds multiplied by 7200. | 0x4650 |
| U32 | RDLT | Ringback cadence delta in seconds multiplied by 7200. | 0xEF10 |



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## User-Access Registers (continued)

| Register | Name | Description | Default |
|---|---|---|---|
| U33 | RMOT | Ringback cadence minimum on time in seconds multiplied by 7200. | 0x1200 |
| U34 | DTWD | Window to look for dialtone in seconds multiplied by 1000. | 0x1B58 |
| U35 | DMOT | Minimum dialtone on time in seconds multiplied by 7200. | 0x2D00 |
| U37 | PD0 | Number of pulses to dial 0. | 0x000A |
| U38 | PD1 | Number of pulses to dial 1. | 0x0001 |
| U39 | PD2 | Number of pulses to dial 2. | 0x0002 |
| U3A | PD3 | Number of pulses to dial 3. | 0x0003 |
| U3B | PD4 | Number of pulses to dial 4. | 0x0004 |
| U3C | PD5 | Number of pulses to dial 5. | 0x0005 |
| U3D | PD6 | Number of pulses to dial 6. | 0x0006 |
| U3E | PD7 | Number of pulses to dial 7. | 0x0007 |
| U3F | PD8 | Number of pulses to dial 8. | 0x0008 |
| U40 | PD9 | Number of pulses to dial 9. | 0x0009 |
| U42 | PDBT | Pulse dial break time (ms units). | 0x003D |
| U43 | PDMT | Pulse dial make time (ms units). | 0x0027 |
| U45 | PDIT | Pulse dial interdigit\ time (ms units). | 0x0320 |
| U46 | DTPL | DTMF power level. 16-bit format is 0x0(H)(L)0 where H is the (-) dBm level of the high frequency DTMF tone and L is the (-) dBm level of the low-frequency DTMF tone. Note that twist may be specified here. | 0x09B0 |
| U47 | DTNT | DTMF on time (ms units). | 0x0064 |
| U48 | DTFT | DTMF off time (ms units). | 0x0064 |
| U49 | RGFH | Ring frequency high - Maximum frequency ring to be considered a valid ring. RGFH = 2400/(maximum ring frequency). | 0x0022 |
| U4A | RGFD | Ring delta RGFD = 2400 Hz x (1/min ring freq (Hz)) - (1/max ring freq (Hz)) | 0x007A |
| U4B | RGMN | Ring cadence minimum ON time in seconds multiplied by 2400. | 0x0258 |
| U4C | RGNX | Ring cadence maximum total time in seconds multiplied by 2400. | 0x007A |
| U4D | MOD1 | bit-mapped register. | 0x0000 |
| U4E | PRDD | Pre-dial delay-time after ATD command that modem waits to dial (ms units). The modem stays on-hook during this time. | 0x0000 |



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## User-Access Registers (continued)

| Register | Name | Description | Default |
|---|---|---|---|
| U4F | FHT | Flash Hook Time. Time corresponding with "!" or "&" dial modifier that the modem goes on-hook during a flash hook (ms units). | 0x01F4 |
| U50 | LCDN | Loop current debounce on time (ms units). | 0x015E |
| U51 | LCDF | Loop current debounce off time (ms units). | 0x00C8 |
| U52 | XMTL | Transmit level (1 dB units) - Sets the modem data pump transmitter level. Default level of 0 corresponds to -9.86dBm. Transmit level = -(9.85 + XMTL dBm. Range = -9.85 to -48. | 0x0000 |
| U53 | MOD2 | This is a bit-mapped register. | 0x0000 |
| U62 | DAAC1 | This is a bit-mapped register. | 0x0804 |
| U63 | DAAC3 | This is a bit-mapped register. | |
| U65 | DAAC4 | This is a bit-mapped register. | 0x00E0 |
| U66 | DAAC5 | This is a bit-mapped register. | 0x0040 |
| U67 | ITC1 | This is a bit-mapped register. | 0x0008 |
| U68 | ITC2 | This is a bit-mapped register. | 0x0000 |
| U6A | ITC4 | This is a bit-mapped register. | N/A |
| U6C | LVS | This is a bit-mapped register. | 0x0000 |
| U6E | CK1 | This is a bit-mapped register. | 0x1F20 |
| U6F | PTMR | This is a bit-mapped register. | 0x00FF |
| U70 | IO0 | This is a bit-mapped register. | 0x2700 |
| U71 | IO1 | This is a bit-mapped register. | 0x0000 |
| U76 | GEN1 | This is a bit-mapped register. | 0x3240 |
| U77 | GEN2 | This is a bit-mapped register. | 0x401E |
| U78 | GEN3 | This is a bit-mapped register. | 0x0000 |
| U79 | GEN4 | This is a bit-mapped register. | 0x0000 |
| U7A | GENA | This is a bit-mapped register. | 0x0000 |
| U83 | NOLN | No-Line threshold. If %V1 is set, NOLN sets the threshold for determination of line present vs. line not present. | 0x0001 |
| U84 | LIUS | Line-in-use threshold. If %V1 is set, LIUS sets the threshold for determination of line in use vs. line not in use. | 0x0007 |
| U85 | NLIU | Line-in-use/No line threshold. If %V2 is set, NLIU sets the threshold reference for the adaptive algorithm (see %V2). | 0x0000 |
| U86 | V9AGG | V.90 rate adjustment for Japan (1333 BPS units). | 0x0000 |



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**User-Access Registers (continued)**

| Register | Name | Description | Default |
|---|---|---|---|
| U87 | SAM | This is a bit-mapped register. | 0x0000 |
| U9F | SASF | SAS frequency detection. | 0x0000 |
| UA0 | SC0 | SAS cadence 0. Sets the duration of the first SAS tone (ms). | 0x01E0 |
| UA1 | SC1 | SAS cadence 1. Sets the duration of the first SAS silence (ms). | 0x0000 |
| UA2 | SC2 | SAS cadence 2. Sets the duration of the second SAS tone (ms). | 0x0000 |
| UA3 | SC3 | SAS cadence 3. Sets the duration of the second SAS silence (ms). | 0x0000 |
| UA4 | SC4 | SAS cadence 4. Sets the duration of the third SAS tone (ms). | 0x0000 |
| UA5 | SC5 | SAS cadence 5. Sets the duration of the third SAS silence (ms). | 0x0000 |
| UA6 | SC6 | SAS cadence 6. Sets the duration of the forth SAS tone (ms). | 0x0000 |
| UA7 | SC7 | SAS cadence 7. Sets the duration of the forth SAS silence (ms). | 0x0000 |
| UA8 | SC8 | SAS cadence 8. Sets the duration of the fifth SAS tone (ms). | 0x0000 |
| UA9 | SC9 | SAS cadence 9. Sets the duration of the firth SAS silence (ms). | 0x0000 |
| UAA | V29MODE | This is a bit-mapped register. | 0x0000 |



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## Bit Mapped U-Register Summary

| Reg. | Name | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U4D | MOD1 | | TOCT | | NHFP | NHFD | CLPD | | FTP | SPDM | | GT18 | GT55 | CTE | | | |
| U53 | MOD2 | REV | | | | | | | | | | | | | | | |
| U62 | DAAC1 | | | | | | | | OHS2 | | | | | | FOH | DL | |
| U63 | DAAC3 | LCS[:0] | | | | | | | | ACT[3:0] | | | | | | | |
| U65 | DAAC4 | | PWMG | PDN | | | | | | | | | PDL | | | | |
| U66 | DAAC5 | | | | | | | | | | FDT | | | | | | |
| U67 | ITC1 | | | MIN[1:0] | | | | ILIM | | DCR | OHS | | | DCV[1:0] | | RZ | RT |
| U68 | ITC2 | | | | | | | | | | | | | | BTE | ROV | BTD |
| U6A | ITC4 | | | | | | | | | | | | | | OVL | | |
| U6C | LVS | LVS[7:0] | | | | | | | | | | | | | | | |
| U6E | CK1 | | | | RI[4:0] | | | | | | | | | | | | |
| U70 | IO0 | HES | | TES | CIDM | OCDM | PPDM | RIM | DCDM | | | | CID | OCD | PPD | RI | DCD |
| U71 | IO1 | | | | | | | | | | | | COMP | | | | PRT |
| U76 | GEN1 | OHSR[7:0] | | | | | | | FACL | DCL[2:0] | | | ACL[4:0] | | | | |
| U77 | GEN2 | IST[3:0] | | | | HOI | | AOC | OHT[8:0] | | | | | | | | |
| U78 | GEN3 | IB[1:0] | | | | | | | | IS[7:0] | | | | | | | |
| U79 | GEN4 | | | | | | | | | | | | LVCS[4:0] | | | | |
| U7A | GENA | | | | | | | | | DOP | ADD | | | | V22HD | HDLC | FAST |
| U7C | GENC | | | | | | | | | | | | RIGPO | | | | RIG-POEN |
| U7D | GEND | | NLM | | | | | | | | | | | | | ATZD | FDP |
| U87 | SAM | | | | | | MINT | SERM | FSMS | XMTT | | | | | | | |
| UAA | V29MODE | | | | | | | | | | | | | | | V29ENA | |



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## Bit Mapped U-Register Detail (defaults in bold)

### U4D MOD1

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | TOCT | | NHFP | NHFD | CLPD | CCAD | FTP | DSPDM | | DGT18 | GT55 | CTE | | | |
| Type | | R/W | | R/W | R/W | R/W | R/W | R/W | R/W | | R/W | R/W | R/W | | | |

Reset Settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15 | Reserved | Read returns 0. |
| 14 | TOCT | **Turn Off Calling Tone.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 13 | Reserved | Read returns 0. |
| 12 | NHFP | **No Hook Flash Pulse.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 11 | NHFD | **No Hook Flash Dial.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 10 | CLPD | **Check Loop Current Before Dialing.** |
| | | **0 = Ignore.** |
| | | 1 = Check. |
| 9 | Reserved | Read returns 0. |
| 8 | FTP | **Force Tone or Pulse.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 7 | SPDM | **Skip Pulse Dial Modifier.** |
| | | **0 = No.** |
| | | 1 = Yes. |
| 6 | Reserved | Read returns 0. |
| 5 | GT18 | **1800 Hz Guard Tone Enable** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 4 | GT55 | **550 Hz Guard Tone Enable.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 3 | CTE | **Calling Tone Enable.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 2:0 | Reserved | Read returns 0. |



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### U53 MOD2

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | REV | | | | | | | | | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15 | REV | **V.23 Reversing** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 14:00 | Reserved | Read returns 0. |

### U62 DAAC1

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | 0 | 0 | 0 | 0 | 1 | 0 | 0 | OHS2 | 0 | 0 | 0 | 0 | 0 | FOH | DL | 0 |
| Type | R/W | | | | | | | | | | | | | R/W | R/W | |

Reset settings = 0x0804

| Bit | Name | Function |
|---|---|---|
| 15:12 | Reserved | Must be set to 0. |
| 11 | Reserved | Must be set to 1. |
| 10:9 | Reserved | Must be set to 0. |
| 8 | OHS2 | **Oh-Hook Speed 2.** |
| | | This bit works in combination with the OHS bit (U67 bit 6) to set the on-hook speed. The on-hook speeds are measured from the time the OH bit is cleared until loop current equals zero. |
| | | **OHS OHS2 Mean On-Hook Speed** |
| | | 0 0 Less than 0.5ms |
| | | 0 1 3 ms ± 10% (meets ETSI standard) |
| | | 1 X 26 ms ± 10% (meets Australia spark quenching spec) |
| 7:3 | Reserved | **Must be set to 0.** |
| 2 | FOH | **Fast Off-Hook.** |
| | | 0 = Automatic Calibration Time set to 426 ms. |
| | | **1 = Automatic Calibration Time set to 106 ms.** |
| 1 | DL | **Isolation Digital Loopback (see the AT&T commands).** |
| | | **0 = Loopback occurs beyond the DAA interface, out to and including the analog hybrid circuit.** |
| | | 1 = Enables digital loopback mode across isolation barrier only. |
| 0 | Reserved | Must be set to 0. |



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### U63 DAAC3

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | LCS[7:0] | | | | | | | | ACT[3:0] | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Rest settings = 0x0003

| Bit | Name | Function |
|---|---|---|
| 15:8 | lcs[7:0] | **Off-Hook Loop Current (1.1 mA/bit).** |
| 7:4 | ACT[3:0] | **AC Termination Select.** |
| | | **ACT[3:0] AC Termination** |
| | | **0000 Real 600 ?** |
| | | 0011 220? + (820? \|\| 120nF) and 220? + (820? \|\| 115nF) |
| | | 0100 370? + (620? \|\| 310nF) |
| | | 1111 Global complex impedance |
| 3:0 | Reserved | Read returns 0x3. |

### U65 DAAC4

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | PWMG | PDN | | | | | | | | | PDL | | | | |
| Type | | R/W | R/W | | | | | | | | | R/W | | | | |

Reset settings = 0x00E0

| Bit | Name | Function |
|---|---|---|
| 15 | Reserved | Read returns 0. |
| 14 | TOCT | **PWM Gain.**<br>**0 = No gain.**<br>1 = 6 dB gain applied to AOUT. |
| 13 | PDN | **Powerdown.**<br>**Completely powerdown the modem chipset. Once set to 1, the modem must be reset to power on.**<br>0 = Normal<br>1 = Powerdown. |
| 12:8 | Reserved | **Read returns 0.** |
| 7:5 | Reserved | **Must not change in a read-modify-write.** |
| 4 | PDL | **Powerdown Line-Side Chip. (Typically used only for debug)**<br>**0 = Normal operation.**<br>1 = Places Line side into powerdown mode. |
| 3:0 | Reserved | Must not change in read-modify-write. |



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**U66 DAAC5**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | FDT | | | | | | |
| Type | R | | | | | | | | | | | | | | | |

Reset settings = 0x0040

| Bit | Name | Function |
|---|---|---|
| 15:7 | Reserved | Read returns 0. |
| 6 | FDT | **Frame Detect. (Typically used only for board-level debug)**<br>0 = Indicates the modem has not established frame lock.<br>1 = Indicates modem frame lock has been established. |
| 5:4 | Reserved | Read returns 0. |
| 3:0 | Reserved | Do not modify. |



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**U67 ITC1**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | MINI[1:0] | | | | ILIM | | DCR | OHS | | | DCV[1:0] | | RZ | RT |
| Type | R/W | | | | | | R/W | | R/W | R/W | | | R/W | | R/W | R/W |

Reset settings = 0x0008

| Bit | Name | Function |
|---|---|---|
| 15:14 | Reserved | Read returns 0. |
| 13:12 | MINI[1:0] | **Minimum Operational Loop Current.**<br>Adjusts the minimum loop current at which the DAA can operate. Increasing the minimum operational loop current can improve the signal headroom at a lower TIP/RING Voltage.<br>**MINI[1:0] Min Loop Current**<br>**00 10 mA**<br>01 12 mA<br>10 14 mA<br>11 16 mA |
| 11:10 | Reserved | Read returns 0. |
| 9 | ILIM | **Current Limiting Enable.**<br>**0 = Current limiting mode disabled.**<br>1 = Current limiting mode enabled. This mode limits loop current to a maximum of 60 mA per the TBR21 standard. |
| 8 | Reserved | Read returns 0. |
| 7 | DCR | **DC Impedance Selection.**<br>**0 - Normal DC Impedance. This mode should be used for all standard applications.**<br>1 = 800? DC termination. |
| 6 | OHS | **On-Hook Speed.**<br>This bit works in combination with the OHS2 bit (U62, bit 8) to set the on-hook speed. The on-hook speeds are measured from the time the OH bit is cleared until loop current equals zero.<br>**OHS OHS2 Mean On-Hook Speed**<br>0 0 Less than 0.5 ms<br>0 1 3ms ± 10% (meets ETSI standard)<br>1 X 26 ms ± 10% (meets Australia spark quenching spec) |
| 5:4 | Reserved | Read returns 0. |
| 3:2 | DCV[1:0 | **TIP/RING Voltage Adjust.**<br>**These bits affect the TIP/RING voltage on the line. Low voltage countries should use a lower TIP/RING voltage. Raising the TIP/RING voltage can improve signal headroom.**<br>**DCV[1:0] DCT Voltage**<br>00 3.1V<br>01 3.2V<br>**10 3.35V**<br>11 3.5V |



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| Bit | Name | Function |
|---|---|---|
| 1 | RZ | **Set this bit to 0.** |
| 0 | RT | **Ringer Threshold Select.**<br>Used to satisfy country requirements on ring detection. Signals below the lower level does not generate a ring detection; signals above the upper level are guaranteed to generate a ring detection.<br>**0 = 11 to 22 $V_{rms}$**<br>1 = 17 to 33 $V_{rms}$ |

**U68 ITC2**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | | | BTE | ROV | BTD |
| Type | | | | | | | | | | | | | | R/W | R/W | R/W |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:3 | Reserved | Do not modify. |
| 2 | BTE | **Billing Tone Protect Enable.**<br>**0 = Disabled.**<br>1 = Enabled.<br>When set, the DAA responds automatically to a collapse of the line-derived power supply during a billing tone event. When off-hook, if BTE = 1 and BTD goes high, the dc termination is released (800? presented to the line).<br>If BTE and RIM (U70, bit 9) are set, an RI (U70, bit1) interrupt also occurs when BTD goes high. |
| 1 | ROV | **Receive Overload.**<br>The bit is set when the receive input has an excessive input level. This bit is cleared by writing a 0 to this location.<br>**0 = Normal receive input level.**<br>1 = Excessive receive input level. |
| 0 | BTD | **Billing Tone Detected.**<br>This bit is set if a billing tone is detected. This bit is cleared by writing a 0 to this location.<br>**0 = No billing tone.**<br>1 = Billing tone detected. |



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### U6A ITC4

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | | | OVL | | |
| Type | | | | | | | | | | | | | | R | | |

Reset settings = N/A

| Bit | Name | Function |
|---|---|---|
| 15:3 | Reserved | Do not modify. |
| 2 | OVL | **Overload Detected.**<br>This bit has the same function as ROV, but clears itself after the overload has been removed. This bit is not affected by the BTE bit. |
| 1:0 | Reserved | **Do not modify.** |

### U6C LVS

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | LVS[7:0] | | | | | | | | | | | | | | | |
| Type | R | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:8 | LVS[7:0] | Line Voltage Status.<br>Eight bit signed, two's compliment number representing the tip/ring voltage. Each bit represents 1V. Polarity of the voltage is represented by the MSB (sign bit).<br>0000_0000 = Measured voltage is < 3V. |
| 7:0 | Reserved | Read returns zero. |

### U6E CK1

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | R1[4:0] | | | | | | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x1F20

| Bit | Name | Function |
|---|---|---|
| 15:13 | Reserved | Do not modify. |
| 12:8 | R1[4:0] | R1 CLKOUT Divider<br>See "World Modem II Programmer's Guide for details. |
| 7:0 | Reserved | Read returns 0. |



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**U70 IO0**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | HES | | TES | CIDM | OCDM | PPDM | RIM | DCDM | 0 | | | CID | OCD | PPD | RI | DCD |
| Type | R/W | | R/W | R/W | R/W | R/W | R/W | R/W | | | | R/W | R/W | R/W | R/W | R/W |

Reset settings = 0x2700

| Bit | Name | Function |
|---|---|---|
| 15 | HES | **Hardware Escape Pin.** |
| | | **0 = Disable.** |
| | | 1 = Enable. |
| 14 | Reserved | Read returns 0. |
| 13 | TES | **Enable "+++" Escape.** |
| | | 0 = Disable. |
| | | **1 = Enable.** |
| 12 | CIDM | **Caller ID Mask.** |
| | | **0 = Change in CID will not affect INT.** |
| | | 1 = A low to high transition in CID activates INT#. |
| 11 | OCDM | **Overcurrent Detect Mask.** |
| | | **0 = Change in OCD does not affect INT. ("X" result code is not generated in command mode.)** |
| | | 1 = A low to high transition in OCD will activate INT. ("X" result code is generated in command mode.) |
| 10 | PPDM | **Parallel Phone Detect Mask.** |
| | | 0 = Change in RI does not affect INT#. |
| | | **1 = A low to high transition in will activate INT.** |
| 9 | RIM | **Ring Indicator.** |
| | | 0 = Change in RI does not affect INT#. |
| | | **1 = A low to high transition in RI activates INT.** |
| 8 | DCDM | **Data Carrier Detect Mask** |
| | | 0 = Change in DCD does not affect INT#. |
| | | **1 - A high to low transition in DCD (U70, but 0), which indicates loss of carrier, activates INT.** |
| 7 | Reserved | **Must be set to zero.** |
| 6:5 | Reserved | Read returns 0. |
| 4 | CID | **Caller ID (sticky).** |
| | | Caller ID Preamble has been detected; data will soon follow. Clears on :I read. |
| 3 | OCD | **Overcurrent Detect (sticky).** |
| | | Overcurrent condition has occurred. Clears on :I read. |
| 2 | PPD | **Parallel Phone Detect (sticky).** |
| | | Parallel phone detected since last off-hook event. Clears on :I read. |
| 1 | RI | **Ring Indicator.** |
| | | Active high bit when the modem is on-hook, indicates ring event has occurred. Clears on :I read. |
| 0 | DCD | **Data Carrier Detect (status).** |
| | | Active high bit indicates carrier detected (equivalent to inverse of DCD# pin). |



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### U71 IO1

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | COMP | | | | PRT |
| Type | | | | | | | | | | | | R/W | | | | R/W |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:5 | Reserved | **Read returns zero.** |
| 4 | COMP | 0 = Disables compression (PCM mode).<br>1 = Enables linear compression. |
| 3:1 | Reserved | Read returns zero. |
| 0 | PRT | **0 = Disables PCM mode.**<br>1 = Enables PCM mode. |

### U76 GEN1

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | OHSR[6:0] | | | | | | | FACL | DCL[2:0] | | | ACL[4:0] | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:5 | OHSR[6:0] | **Off-Hook Sample Rate (40 ms units).**<br>Sets the sample rate for the off-hook intrusion algorithms (1 second default). |
| 8 | FACL | **Force ACL.**<br>**0 = While off-hook, ACL is automatically updated with LVCS.**<br>1 = While off-hook, ACL does not change from the value written to it while on-hook. |
| 7:5 | DCL[2:0] | **Differential Current Level (3 mA units).**<br>Sets the differential level between ACL and LVCS that will trigger an off-hook PPD interrupt (default = 2). |
| 4:0 | ACL[4:0] | **Absolute Current Level (3 mA units).**<br>ACL represents the value of LVCS current when the modem is off-hook and all parallel phone are on-hook. If ACL = 0, it is ignored by the off-hook intrusion algorithm.<br>The modem will also write ACL with the contents of LVCS before and intrusion and before going on-hook (default = 0) |



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**U77 GEN2**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | IST[3:0] | | | | HOI | | AOC | OHT[8:0] | | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x401E

| Bit | Name | Function |
|---|---|---|
| 15:12 | IST[3:0] | **Intrusion Settling Time (250 ms units).**<br>Delay between when the modem goes off-hook and the off-hook intrusion algorithm begins. Default is 1 s. |
| 11 | HOI | **Hang-Up On Intrusion.**<br>**0 = Modem will not automatically hang up when and off-hook PPD interrupt occurs.**<br>1 = Modem automatically hangs up on a PPD interrupt. If %Vn command are set, HOI also causes the "LINE IN USE" result code upon PPD interrupt. |
| 10 | Reserved | Read returns zero. |
| 9 | AOC | **Auto Overcurrent.**<br>**0 = Disable**<br>1 = Enable<br>Note: AOC may falsely detect an overcurent condition in the presence of line reversals or other transients.<br>Therefore, it should not be used where line reversals are common or may be expected. |
| 8:0 | OHT[8:0] | **Off-Hook Time (1 ms units).**<br>Time before LVCS is checked for overcurrent condition after going off-hook (30 ms default). |



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**U78 GEN3**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | IB[1:0] | | | | | | | | IS[8:0] | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:14 | IB[1:0] | **Intrusion Blocking.**<br>Defines the method used to block the off-hook intrusion algorithm from operation after dialing has begun. |
| | | **0 = No intrusion blocking.**<br>1 = Intrusion disabled from start of dial to end of dial.<br>2 = Intrusion disabled from start of dial to IS register time-out.<br>3 = Intrusion disabled from start of dial to connect ("CONNECT XXX", "NO DIALTONE", or "NO CARRIER"). |
| 13:8 | Reserved | Read returns zero. |
| 7:0 | IS[8:0] | **Intrusion Suspend (500 ms units).**<br>When IB = 2, this register sets the length of time from when the dialing begins that the off-hook intrusion algorithm is blocked (suspended) (default = 00000000b). |



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**U79 GEN4**

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | LVCS[4:0] | | | | |
| Type | R | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:5 | Reserved | Read returns 0. |
| 4:0 | LVCS[4:0] | **Line Voltage Current Sense.**<br>Represents either the line voltage, loop current, or on-hook line monitor.<br>**On-Hook Voltage Monitor (2.75 V/bit ±20%)**<br>00000 = No line connected.<br>00001 = Minimum line voltage ($V_{min}$ = 3.0V ± 0.5V).<br>11111 = Maximum line voltage (87V ± 20%)<br>Off-Hook Loop Current Monitor (3 mA/bit).<br>00000 = No loop current.<br>00001 = Minimum loop current.<br>11110 = Maximum loop current.<br>11111 = Loop current is excessive (overload).<br>Overload > 140 mA in all modes except TBR21<br>Overload > 54 mA in TBR21 mode |



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## U7A GENA

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | DOP | ADD | | | | | V22HD | HDLC | FAST |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:8 | Reserved | Read returns zero. |
| 7 | DOP | **Dial or pulse**<br>**0 = Normal ATDTW operation**<br>1 = Use ATDTW for Pulse/Tone Dial Detection (see also ATDW command) |
| 6 | ADD | **Adaptive Dialing**<br>0 = Disable.<br>**1 = Enable.**<br>Attempt DTMF dial the fall back to pulse dial if unsuccessful. First digit is dialed as DTMF. If a dialtone is still present after two seconds, the modem will redial as pulse.<br>If no dialtone detected after two seconds, the modem will continue to dial as DTMF. |
| 5:3 | Reserved | Read returns zero. |
| 2 | V22HD | **V.22bis Synchronous Mode***<br>**0 = Normal ATDTW operation**<br>1 = Use ATDTW for Pulse/Tone Dial Detection (see also ATDW command) |
| 1 | HDLC | **Synchronous Mode***<br>**0 = Normal asynchronous mode.**<br>1 = Transparent HDLC mode. |
| 0 | FAST | **Fast Connect***<br>**0 = Normal modem handshake timing per ITU/Bellcore standards.**<br>1 = Fast connect modem handshake timing. |
| *Note: When V22HD, HDLC or FAST bits are set \N0 (wire mode) must be used. | | |



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### U7C GENC

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | RIGPO | | | | RIGPOEN |
| Type | | | | | | | | | | | | R | | | | R/W |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:5 | Reserved | Read returns zero. |
| 4 | RIGPO | **RI#**<br>RI#, follows this bit when RIGPIOEN = 1b. |
| 3:1 | Reserved | Read returns zero. |
| 0 | RIGPOEN | **0 = RI# indicates valid ring signal. (Normal ring-indicator mode)**<br>1 = RI# can be used as general purpose output and follows U7C[4] (RIGPO). |

### U7D GEND

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | NLM | | | | | | | | | | | | | ATZD | FDP |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15 | Reserved | Read returns zero. |
| 14 | NLM | **0 = Enables "No Loop Current" detect.**<br>1 = Disables "No Loop Current" detect. |
| 13:2 | Reserved | Read returns zero. |
| 1 | ATZD | **ATZ Disable**<br>**0 = ATZ functions normally.**<br>1 = Disable ATZ command. |
| 0 | FDP | **FSK Data Processing**<br>**0 = FSK data processing stops when carrier is lost.**<br>1 = FSK data processing continued for 2 bytes after carrier is lost. |



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### U87 SAM

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | MINT | SERM | FSMS | XMITT | | | | | | | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:11 | Reserved | Read returns zero. |
| 10 | MINT | **Minimal Transparency**<br>**0 = Generates two-byte <EM> transparency sequences.** This option will use codes <EM><T5> through <EM><T20>, if possible, for received data conning two back-to-back bytes requiring transparency.<br>1 = Generates one-byte <EM> transparency sequences. This option will only use codes <EM><T1> through <EM><T4> for received data. |
| 9 | SERM | **Special Error Reporting Mode**<br>**0 = Ignore unrecognized in-band commands.**<br>1 = Generate <EM><0x45> ("E" for error) in response to any unrecognized in-band commands. |
| 8 | FSMS | **Framed Sub-Mode Startup**<br>**0 = Upon successful connection, enter Transport Sub-Mode. An <EM><FLAG> is required to enter Framed Sub-Mode.**<br>1 = Upon successful connection, immediately enter Framed Sub-Mode. The first received <EM><ERR> from a successful hunt is transformed into an <EM><flag>. |
| 7:0 | XMTT | **Transmitter Threshold**<br>This value represents the number of bytes before a transmission is started.<br>The following values are special:<br>0 The same as ten. Upon receipt of ten bytes, data is transferred. The DTE must supply a closing flag within the required time or an underrun will occur.<br>255 The same as infinity, e.g. never start a packet until the closing flag is received. |

### UAA V.29 Mode

| Bit | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | | | | | | | | | | | | | | | V29ENA | |
| Type | R/W | | | | | | | | | | | | | | | |

Reset settings = 0x0000

| Bit | Name | Function |
|---|---|---|
| 15:2 | Reserved | Read returns zero. |
| 1 | V29ENA | **0 = Disables V.29.**<br>1 = Enables V.29. |
| 0 | Reserved | **Read returns zero.** |



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## Revision Information

**Revision 1.0 to Revision 1.1**

- Removed unused U registers.
- Updated PCB layout drawings
- Added FCC statement



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