Chapter 13 Modems

This chapter discusses modems that connect directly or indirectly to the Public Switched Telephone Network (PSTN). These include:

- Voiceband modems used for data, fax, voice, text telephony, or video telephony.
- ISDN modems.
- Cellular and wireless modems, such as global system for mobile communications (GSM).

Unless this chapter defines a specific requirement or exception, all requirements for modems apply as presented in Chapter 3, "PC System," and Chapter 6, "Buses and Interfaces."

Voiceband Modems

This section describes the basic features required for all voiceband modems.

MOD–0366. Modem driver supports Unimodem

The device driver must include universal modem driver (Unimodem) support. Typically, this requires a modem INF file, developed and verified using the Modem Developers Kit (MDK) and pretested by the modem manufacturer.

MOD–0367. Modem meets PC 2001 controller requirements

The modem controller must support the following:

- AT command buffer of at least 60 characters
- Semicolon (;) character dial string modifier, except when the modem is configured for operation in those countries that prohibit this dial modifier
- Unimodem Diagnostics command, AT#UD

The modem controller must also be capable of software-based feature upgrades, such as providing upgradeable ROM or a driver-based modem that meets the requirements in "Driver-based Modems" later in this chapter.

MOD–0368. Modem supports V.250 AT command set

International Telecommunication Union (ITU) Recommendation V.250 is a superset of the TIA-602 basic AT command set with significant and useful improvements. The following V.250 commands must be supported:

- All basic mode commands from TIA-602 (no + prefix)
- Identification: +GMI, +GMM, +GMR, +GCI
- Port control: +IPR, +ICF, +IFC, +ILRR, +ITF (defined in V.80)
- Modulation: +MS, +MR, +MA
- Error control: +ES, +ER, +EB, +ESR, +ETBM
- Compression: +DS, +DR

If the AT command for a particular function is implemented, the corresponding V.250 AT command must be supported.

The modem must also be able to generate appropriate V.250 responses enabled by the +ILRR, +MR, +ER, and +DR commands.

MOD–0369. Data modem meets PC 2001 protocol requirements

A PC 2001 modem must support the following protocols:

- V.90 modulation
- V.42 Link Access Protocol Modem error control
- V.42 *bis* data compression
- V.80 synchronous data access protocol

MOD–0370. Modem supports call control signaling, controlled using V.251 modem commands

Modems must support the ITU V.251 standard for PC-controlled call control, including:

- DCE-controlled V.8 operation with DTE notification.
- DTE-controlled V.8 operation (<a8a> values of 2, 3, and 4).
- DTE-controlled V.8 *bis* operation.
- Backward compatibility for media detection with terminals using V.25 signaling, for example, data calling tone and fax calling tone.
- Backward compatibility for media detection with older modems, for example, V.32 and V.32 bis.

Modems must provide a means for turning on the V.8 Calling Indicator signal for originating calls. Modems must also meet requirements stated in the *Videophone-ready Modem Handbook, Version 1.0*, which describes the specific implementation details essential to support H.324 voice-band video conferencing.

MOD–0371. FAX modem supports 14.4 Kbps (V.17) with Class 1 command set

If fax modem capabilities are implemented, the fax modem must support 14.4 kilobits per second (Kbps) (V.17) with the Class 1 (ITU T.31) command set.

If fax modems include dax/data media detection (for example, T.32 +FAA command), the INF file must include the necessary registry keys, as defined in the MDK, which is provided in the Windows DDK.

MOD–0372. If delayed and blacklisted number tables are implemented, modem generates appropriate error messages

During certain international Post, Telephone, and Telegraph certification processes, modems must support the delayed and blacklisted numbers feature. For details, see European Telecommunications Standards Institute (ETSI) ETS 300 001.

For Windows compatibility, modems that support delayed and blacklisted number tables must:

- Generate end-user legible error messages to report these conditions.
- Provide modem INF file drivers that translate these error messages for Unimodem and Telephony Application Program Interface (TAPI).

MOD–0373. If TDD support is implemented, modem complies with TDD, meeting V.18-1996 with V.250 AT commands

People who are deaf or hard-of-hearing, and people who are unable to speak or who use synthetic speech, can communicate over phone lines using a TDD, also known as a Text Telephone.

ITU Recommendation V.18 codifies how all these devices work and how to adaptively connect to all of them. ITU Recommendation V.250 contains these AT commands for control of V.18 features in a modem: +MV18S, +MV18R, +MV18AM, +MV18P. Modems that support text telephony must support those parts of V.18 applicable to their target countries, and the V.18 commands listed earlier.

MOD–0374. If voice modem is implemented, it supports ITU V.253 (AT+V)

Voice modem features that are implemented must use the corresponding commands and responses defined in V.253.

MOD–0375. If implemented, V.253 modem supports duplex audio (+VTR)

The required formats for duplex audio are for 8-bit 8 kHz: unsigned linear and G.711.

MOD–0376. If Caller ID detection is implemented, modem supports Caller ID Reporting using +VCID and +VRID commands

If Caller ID detection is implemented, reporting must be controlled with the AT+VCID command from V.253. If Caller ID message reporting is implemented, it must be controlled with the AT+VRID command from V.253.

MOD–0377. Modem can connect, stay connected, and successfully transfer data simultaneously

This requirement states a basic criterion for modem functionality. While operating in the default modem configuration on TIA-3800 line I01d-loop 3, the modems must be able to transfer a typical file in 40 minutes or less, simultaneously in both directions, without hanging up or otherwise aborting the transfer. Data transmission is required to be run directly on the modems without the use of an additional protocol such as Zmodem.

The analog V.90 modem subject to this requirement must meet it when connected to digital V.90 modems commonly deployed by Internet service providers (ISPs). For modems certified for operation only in countries outside of North America, the requirement is for operation on impairment combination 2C4, as specified in International Telecommunication Union – Telecommunication Standardization Sector (ITU-T) Recommendation V.56 *bis*. V.56 *bis*. specifies that the modem must be connected to an identical analog modem, rather than a digital V.90 modem.

TIA TSB-38 provides detailed test procedures and criteria.

MOD–0378. Modem reliably connects numerous times on good telephone channels

This requirement cites basic modem functionality. While operating in the default configuration, the modem must be able to repeatedly connect, with an overall call completion success ratio of 97 percent and without the modem stalling in an unresponsive, inoperable state. This requirement must be met while operating on channels I01d from TIA-3800.

The analog V.90 modem must meet this requirement when connected to digital V.90 modems commonly deployed by ISPs.

TIA TSB-38 provides detailed test procedures and criteria for modems certified for operation in North America. ITU-T Recommendation V.56 *ter* provides detailed test procedures for modems only certified for operation outside of North America.

MOD–0379. Modem pair functions concurrently with other applications

For this requirement, the modem must be able to sustain a connection for at least 30 minutes, at no less than 90 percent of the initial connection rate and with no more than 2 retrains, while typical communications applications are running over the modem link on the PC, including:

- E-mail: Outlook Express over Hotmail.
- Web browsing: Internet Explorer.
- Video teleconferencing: Netmeeting.

To meet this requirement, the analog V.90 modem must sustain connectivity when connected to digital V.90 modems commonly deployed by ISPs, using the same channel as described in MOD–0378, "Modem reliably connects numerous times on good telephone channels."

MOD–0380. All external USB modems support USB specifications

An external modem must comply with all related USB specifications, including:

- *Universal Serial Bus Specification, Revision 1.1.*
- *Universal Serial Bus Class Definitions for Communication Devices, Version 1.0*

External modems may also support V.24 (RS-232) serial interfaces for legacy connectivity.

For compatibility with Unimodem and Windows USB serial drivers, a USB modem that incorporates the modem controller function must support the mandatory and optional requests and notifications for Abstract Control Model Serial Emulation defined in section 3.5.1.2.1 of the *Universal Serial Bus Class Definitions for Communication Devices, Version 1.0* specification.

Alternatively, external modems may support IEEE 1394 or Bluetooth instead of USB. If implemented as external Bluetooth modems, they must support one of the applicable profiles defined by the Bluetooth SIG specifications, such as Dial Up Networking (K:7), FAX profile (K:8), or LAN Access (K:9). For more information on Bluetooth specifications, see *Specification of the Bluetooth System, Volume 1: Core, v1.0 B,* and *Volume 2: Profiles, v1.0 B,* listed in "Modems References."

MOD–0381. Modem complies with device class power management reference specification

The *Communications Device Class Power Management Reference Specification, Version 1.0*, provides definitions for the OnNow device power states (D0–D3) for modems. The specification also covers the device functionality expected in each power state and the possible wakeup event definitions for the class.

Power states D0 and D3 are required for modems on power-managed buses, including PCI, CardBus, and USB. Modem adapters that use the PCI bus must be capable of generating a power management event (PME# assertion) from the $D3_{cold}$ device state.

MOD–0382. Modem supports wakeup events

A modem must be able to cause a wakeup event on an incoming ring as defined in the *Communications Device Class Power Management Reference Specification.* This requirement applies for modems on all power-managed buses, including PCI, CardBus, and USB.

The D2 power state is defined specifically for this purpose in the power management reference specification. The ability for a modem to cause a wakeup event from the D3 power state is also possible (D3 realizes better system power savings). To comply with this requirement, a modem must be able to cause a wakeup event from the D2 state, the D3 state, or both states.

PCI modem devices are required to support wake from $D3_{cold}$ on a system with auxiliary power. On all other power-managed buses (such as USB), support for either D2 or D3 is acceptable.

Driver-based Modems

This section covers requirements for controllerless or "soft" modems, whereby the modem controller function, or both the modem controller and the modem datapump functions, are implemented on the Windows host.

MOD–0383. Driver-based modem uses a WDM-based driver solution

Windows Me and Windows 2000 use the same WDM kernel calls. Driver-based modems must use the WDM kernel so that both operating systems can use a common driver binary. For Windows 2000, these drivers must also support symmetric multiprocessors.

ISDN Modems

This section covers requirements for serial-port connected ISDN terminal adapters, commonly referred to as "ISDN modems." See also "ISDN Requirements" in Chapter 14.

MOD–0384. ISDN modem supports required command set

An ISDN modem must support the following:

- Basic AT commands such as TIA-602, which is a subset of ITU V.250
- Commands to select the end-to-end protocol used over the ISDN, for example, synchronous point-to-point protocol (PPP), V.110, V.120, and so on
- Commands to set the switch type, subscriber numbers, or directory numbers
- Service profile ID (SPID) or EndgerateAushlZiffer (EAZ) (where applicable) for user selection or if auto-detection fails, implemented in the device or in the communications driver

MOD–0385. ISDN modem supports asynchronous-to-synchronous conversion and RFC 1662

Because ISDN is a synchronous service and an ISDN modem connects to a logic asynchronous USB port on the PC, the device must provide some means of converting asynchronous data to synchronous data. The asynchronous-to-synchronous conversion must support the requirements identified in RFC 1662.

Mobile Modems

This section covers the particular requirements of modems used in mobile systems. These are in addition to the requirements in the "Voiceband Modems" section earlier in this chapter.

MOD–0386. If wireless support is implemented, Mobile PC modem supports +WS46 command

Wireless modems and look-alike modems include the common types, such as North American analog cellular, cellular digital packet data (CDPD), GSM, and other digital cellular systems, as well as several other types.

All wireless and cellular modems must use the +WS46 command, which selects the WAN.

The TIA-678 +WS46 command has codes to indicate the system in which the modem can operate. For example, the following values, quoted from Table 4 of the standard, are useful.

Value	System
1	Public telephone network (that is, a normal wireline modem)
4	CDPD
7	TIA-553 analog cellular system
10	Metricom Ricochet network
12	GSM digital cellular system
13	TIA IS-95 CDMA digital cellular
14	TIA IS-136 TDMA digital cellular (Personal Communications System)

Windows has registry keys that support analog cellular modems. Windows also supports data access in GSM and other wireless modem types.

MOD–0387. If digital cellular control is implemented, Mobile PC modem supports appropriate +C digital cellular standards

If digital cellular support is implemented, the following appropriate digital cellular control standards must be supported.

Standard	System and services
GSM 7.07	GSM system: data, fax, voice
GSM 7.05	GSM SMS
TIA IS-707	North American CDMA: data and fax
TIA IS-135	North American TDMA: data and fax

The following commands are required:

- +CBC battery power monitoring command
- +CPAS phone activity status
- +CSQ signal quality-monitoring command
- +CBST protocol selection command for GSM modems
- Class 2.0 facsimile services, per appropriate standard

Digital cellular communications equipment must default to using error correction on the radio link. For example, for GSM 7.07, the modem must initialize to +CBST=,,1 (which selects a "nontransparent" air interface).

To allow data cards to use GSM/ISDN V.110 "fast access" where available in the network, +CBST=71,, (9600 bits per second (bps) V.110) must be a valid setting.

MOD–0388. If SMS support is implemented, the modem supports appropriate +C SMS control commands

To allow software applications to specify settings and manipulate short messaging services (SMS) through a GSM modem card, the card must support the following GSM 07.05 commands:

+CMGF: Message Format	+CPMS: Preferred Message Storage
+CMGL: List Messages	+CRES: Restore Settings
+CMGR: Read Messages	+CSAS: Save Settings
+CMGS: Send Messages	+CSCA: Service Center Address
+CMGW: Write Messages	+CSCS: TE character set selection
+CNMI: New Message Indications to terminal equipment (TE)	+CSMS: Select Messaging Service

Unlike wireline data modems, these devices are not required to support V.34 signaling because none is available. Only 9600 bps capability is required.

Telephony

The increasing confluence of voice and data networks is driving the increased use of the PC as a communications device. PC systems that are compatible with acoustic requirements of the telephony network support easy and efficient two-way interactive voice communications, such as telephony, allowing users to use their existing PC audio devices for communication.

MOD–0389. System with telephony applications uses a common set of audio I/O devices for system audio and telephony applications

If the system enables telephony applications such as speakerphone, IP telephone, and so on, then for each type of audio I/O device, the same device must be usable for both system audio and telephony. For example, the same set of speakers must be usable for both system audio and speakerphone functions. When using a headset, users must not need to change plug locations when switching from, for example, listening to CD-audio to speaking on the phone.

This requirement ensures that one convenient, unambiguous I/O connector is provided for each type of audio I/O device. It does not mandate that all audio I/O is delivered to a single I/O device at all times. For example, providing system audio sounds to the speakers while simultaneously using a headset for IP telephony would not be prohibited.

MOD–0390. Telephony applications provided with a PC 2001 system meet industry telephony performance requirements

If the system enables telephony applications that support devices, such as speakerphone or handset telephony, using various types of connections, such as plain old telephone service (for example, through a voice modem) or IP (through a network connection), the applications provided with the system must comply with telecommunications industry requirements for such parameters as send and receive loudness, echo, and so forth.

Speakerphone applications must meet the requirements in ITU-T Recommendation P.340, *Transmission characteristics of hands-free telephones*. Other applications must meet the requirements in ITU-T Recommendation P.310, *Transmission characteristics for telephone band (300-3400 Hz) digital telephones*. For additional information for IP telephony functions, see U.S. Committee T1 Technical Report No. 56, *Performance guidelines for voiceband services over hybrid internet/PSTN connections,* which provides useful guidance for IP telephony functions.

Modems References

Following are the references, services, and tools cited in this chapter that are available to help build hardware that works optimally with Windows operating systems.

Communications Device Class Power Management Reference Specification, Version 1.0

http://www.microsoft.com/hwdev/specs/PMref/

European Telecommunications Standards Institute (ETSI) or Global System for Mobile (GSM) standards

E-mail: publications@etsi.fr
http://www.etsi.org

ITU communications standards

ITU Sales
E-mail: sales@itu.int
http://www.itu.int

Plug and Play specifications

http://www.microsoft.com/hwdev/respec/pnpspecs.htm

RFC 1662

http://www.rfc-editor.org/rfc.html

Specification of the Bluetooth System, Volume 1: Core, v1.0 B
Specification of the Bluetooth System, Volume 2: Profiles, v1.0 B

Bluetooth Special Interest Group (SIG)
http://www.bluetooth.com

TIA and other standards

Global Engineering Documents
E-mail: global@ihs.com
http://global.ihs.com

Unimodem Diagnostics Command Reference Specification

http://www.microsoft.com/hwdev/respec/commspec.htm

Universal Serial Bus Class Definitions for Communication Devices, Version 1.0

http://www.usb.org/developers/devclass_docs.html

Universal Serial Bus Specification, Revision 1.1

http://www.usb.org/developers/docs.html

Videophone-ready Modem Handbook, Version 1.0

http://developer.intel.com/ial/vidred/index.htm

Windows 98 DDK and Windows 2000 DDK, including information about WDM and Windows MDK

http://www.microsoft.com/ddk/

Checklist for Modems

MOD–0366. Modem driver supports Unimodem

MOD–0367. Modem meets PC 2001 controller requirements

MOD–0368. Modem supports V.250 AT command set

MOD–0369. Data modem meets PC 2001 protocol requirements

MOD–0370. Modem supports call control signaling, controlled using V.251 modem commands

MOD–0371. FAX modem supports 14.4 Kbps (V.17) with Class 1 command set

MOD–0372. If delayed and blacklisted number tables are implemented, modem generates appropriate error messages

MOD–0373. If TDD support is implemented, modem complies with TDD, meeting V.18-1996 with V.250 AT commands

MOD–0374. If voice modem is implemented, it supports ITU V.253 (AT+V)

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MOD–0378. Modem reliably connects numerous times on good telephone channels

MOD–0379. Modem pair functions concurrently with other applications

MOD–0380. All external USB modems support USB specifications

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