

K56flex™ Frequently Asked Questions

Q1: Is K56flex™ technology a further refinement of V.34 technology and will it be used in the same home-to-home applications?

A: No. K56flex™ technology is based on a totally different concept from the V.34 modems widely used in home-to-home connections as shown in Figure 1. It takes advantage of today's Internet access explosion which creates a new connection topology where the end-user modem connects via analog phone line to a server site modem which is directly linked to the digital telephone network via a T1 or PRI line (shown in Figure 2). This new type of connection can therefore be defined as a home-to-ISP (Internet Service Provider) connection.

Figure 1. Typical home-to-home V.34 modem connection

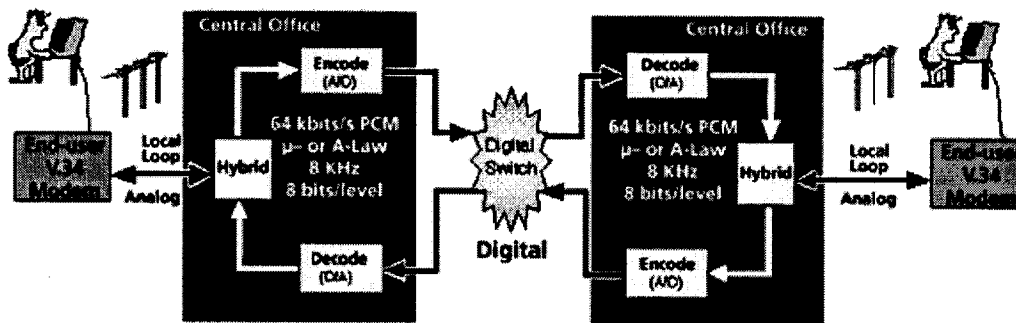
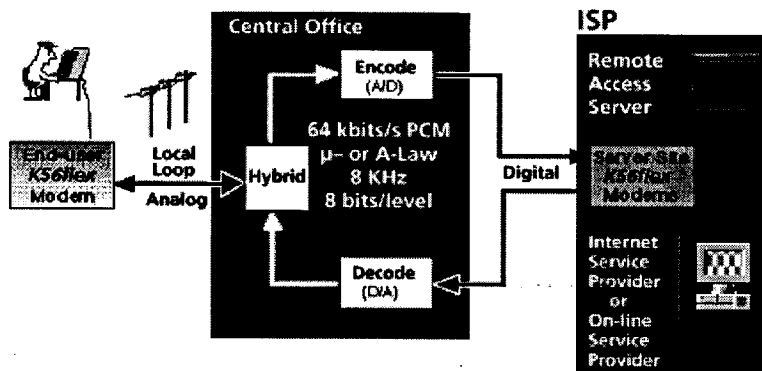


Figure 2. K56flex™ in home-to-ISP connection



Q2: What is K56flex™ Technology?

A: Lucent and Rockwell on 11/15/96 announced their intention to make their respective modem chip sets interoperable. By agreeing to interoperate, Lucent & Rockwell are providing the industry with an interoperable high speed modem protocol that will revolutionize Internet communications. The interoperable high speed modem protocol is called K56flex™.

Q3: What companies have announced support for K56flex™ technology?

A: So far, America Online, Ascend Communications, BBN, Best Data, Compaq Computer, Earthlink, Concentric Networks, Diamond Multimedia, Hayes Microcomputer Products, Hewlett-Packard, Livingston, Multi-Tech Systems, Motorola, Prodigy, UUNet, and Xircom have announced they will use K56flex™, and over 700 ISPs and manufacturers are endorsing the K56flex™ technology. The main thrust of these announcements is that these companies endorse interoperability of the K56flex™ technology because they recognize the importance of an interoperable high-speed modem technology.

Q4: How can K56flex™ achieve faster speeds than V.34 33.6 kbits/s which is already very close to the well-known Shannon's limit of channel capacity?

A: Shannon's Law theoretically defines the maximum channel capacity (line speed) based on the impairments (including all kind of noise) in the telephone link between two points and the bandwidth of the channel. In home-to-home connections (shown in Figure 1), the telephone network will first convert the analog signal transmitted from user A's modem to a digital signal which will then be transmitted digitally from the central office in user A's area to the central office in the user B's area where the digital signal will be converted back to an analog signal before being sent via analog phone line to user B's modem. The noise introduced by the telephone network's analog-to-digital converter is a dominant impairment (called quantization noise) in this type of connection in which the maximum speed is therefore determined by Shannon's Law at around 35 kbits/s. In a home-to-ISP type of connection (shown in Figure 2), K56flex™ takes advantage of the fact that the network has no analog-to-digital conversions in the end-user's downloading (downstream) path and effectively eliminates the quantization noise impairments introduced by the telephone network.

Q5: What are the keys to K56flex™?

A: K56flex™ takes advantage of having direct access to the digital telephone network at one end of a connection. First, the end point K56flex™ modem must synchronize with the telephone network's digital system. Secondly, the ISP K56flex™ modem will encode and map the bit stream into the different symbols matching the telephone network's digital system (μ - or A-law PCM). Those bit-encoded symbols will then be represented as different voltage levels in an analog format and will be received by the end point K56flex™ modem. Lastly, the end point K56flex™ modem has to equalize the channel with respect to analog loop characteristics and intersymbol interference (ISI).

Q6: Will the upstream speed be limited to V.34 rates?

A: Not necessarily. The initial version of K56flex™ will use V.34 rates for upstream (uploading), which has been selected by the TIA for the U.S. interim high speed modem standard. Lucent is expecting to upgrade its future K56flex™ product software, via its RAM based solution, which will utilize additional techniques to enable rates higher than V.34 rates in the upstream direction. Again the key is having digital access at one end of the connection which is not available in a home-to-home connection. With only one analog loop in the path, there are fewer impairments than conventional V.34 connections (2 loops). Higher rates and better performance than V.34 are expected.

Q7: Is a modem useful if the highest speed is offered in only one direction?

A: Traditional Internet access is a highly asymmetrical process in that most data flows from the Internet to the end user (downstream) in the form of graphics or files. Most communications from the end user to the Internet (upstream) is button clicks or address entries. K56flex™ is therefore ideal for Internet connections.

Q8: Is a "home-to-ISP" user connection to the Internet the only application for K56flex™ technology?

A: No. This technology is useful for several applications where one end of the connection is digitally terminated. Some alternate applications include enterprise solutions where users connect to a private business server, bridging connections where a service provider utilizes two or more digitally terminated modems and two or more end users call in to these modems and have their data bridged digitally by the service, and finally, end-user digitally terminated modems such as ISDN combo modems where an end user is digitally terminated and can therefore communicate with another end-user K56flex™ modem.

Q9: Can two K56flex™ modems connect at rates higher than V.34 when used in a home-to-home connection?

A: No. The K56flex™ technology is uniquely designed for home-to-ISP connections with the condition that one end (typically ISP site) has digital access to the telephone network and the other end (typically end-user) connects to an analog phone line. However, K56flex™ modems will automatically connect to each other in V.34 mode when used in home-to-home connections.

Q10: Will K56flex™ modems interoperate with today's analog modems such as V.34?

A: Yes. K56flex™ modems will automatically detect the capabilities of a remote modem and "automode" to the capability of the remote modem. Moreover, if a combination of network and local loop conditions prevent a K56flex™ connection, a fall back to a V.34 connection will occur.

Q11: If I purchase a K56flex™ modem, will I always connect at the speeds possible with K56flex™ technology?

A: K56flex™ rates can be achieved ONLY when they are used in pairs (K56flex™ end-user modem connects to a K56flex™ ISP-site modem). Therefore, K56flex™ modems must be deployed at all the sites you plan to call. As previously mentioned, a K56flex™ modem will automode to V.34 if the remote modem lacks K56flex™ capabilities or a combination of network and or phone line conditions that prevent a K56flex™ connection.

Q12: Will K56flex™ modems connect with other high speed modems announced recently by other manufacturers?

A: It appears that although the basic concepts used in other high speed technologies are similar, it is unlikely that the various protocols will interoperate. K56flex™ compliant modems will interoperate with ISPs that offer K56flex™ service. K56flex™ modems will however fall back to a V.34 connection if the other modem is not a K56flex™ modem.

Q13: Won't this technology hurt the market for ISDN?

A: Actually, ISDN can provide 128 kbits/s data transmission without any compression, and can reach 512 kbits/s with compression. Also, keep in mind that the fastest speed these modems can reach is dependent on the phone line conditions and other network related issues. On the other hand, with ISDN, 128 kbits/s is virtually guaranteed. K56flex™ modems are designed to be less expensive and easier to set up for end users that want higher speed connections to the Internet.

Q14: Will K56flex™ technology be available internationally?

A: Yes. Although it will be initially deployed in the United States, this technology will be deployed subsequently in Europe and Asia. Most countries other than the United States have A-law rather than μ -law compression, and the algorithm takes this into account.

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