

Multi-Tech Systems

Wireless Technology Guide



Whether you need to install a security and surveillance solution, manage a fleet of vehicles, or collect data from a mobile health device, the ability to monitor and manage remote assets in real-time holds many benefits. Integrating wireless communications can improve device functionality, facilitate better and faster decision-making, enhance services and reduce costs. However, it can also take you down an unfamiliar path of selecting carriers, certifications, hardware selection, and solution integration, which all play a role in cost-effectiveness, time-to-market, and the risks at stake. Understanding some of the fundamentals upfront can help enable quicker deployments and minimize total cost of ownership. This guide aims to arm you with some of the essentials to get you moving in the right direction.

Selecting Your Wireless Technology

GSM and CDMA are two primary cellular technologies available today. Each of these technologies was initially deployed as voice networks by independent Mobile Operators in the 1990s. Since then, data functionality has been added allowing Mobile Operators to offer mobile-to-Internet communication for personal computers and other devices. The Internet function of cellular networks is based upon TCP/IP, the language of the Internet, and is synonymous with the Packet Data Protocol.

A key difference between the two major cellular technologies is how they transfer the data for efficiency and speed. GSM (Global Systems Mobile) technology divides the frequency bands into multiple channels so that more than one user can send data through one tower at the same time; CDMA (Code Division Multiple Access) networks layer digitized "calls" over one another, and unpack them on the back end with sequence codes.

Deciding whether to use CDMA or GSM is often determined by which carrier you intend to use, their coverage area and the geographic locations in which your solution will be deployed. Another consideration is deciding whether or not you need 2G or 3G. Each carrier has its version of both. The determining factors here will be the amount of data being sent, the frequency with which it must be sent, and the time window within which the data must be sent or received. For instance, a remote monitoring application with occasional, small data transfers might only need 2G. If the monitoring required quicker data transfer or data transfer within a given time period, 3G would be necessary. In another example, a surveillance solution with a web camera is usually best served with 3G connectivity because of the amount of data being sent. The tables below show the cellular technologies and their associated maximum theoretical data throughput rates, which are affected by environmental and network capabilities. Typical data rates are normally about half of the maximum theoretical data rate.

GSM Cellular Technology

Generation	Packet Data Version	Download Speed	Upload Speed
2G	GPRS	85.6K bps	42.8K bps
2.5G	EDGE	236.8K bps	118.4K bps
3G	HSPA	7.2M bps	5.76M bps

CDMA Cellular Technology

Generation	Packet Data Version	Download Speed	Upload Speed
2G	1xRTT	153.6K bps	153.6K bps
3G	EV-DO Rev. A	3.1M bps	1.8M bps

Wireless Internet Access

The Mobile Operator functions as your Internet Service Provider (ISP) to allocate IP addresses and route data from your mobile connected device to and from the Internet.

The following factors need to be addressed when assessing Mobile Operator data plans:

- Mobile Originate and Mobile Terminate communications
- Device and data security
- Private, static IPs
- Data pooling and custom wireless plans
- International coverage

If the product will always initiate a data connection (mobile originate), a basic data plan that supports dynamic private IP is sufficient. If the product needs to be contacted by a remote computer over the Internet (mobile terminate), the remote computer needs to know the public IP address of the device. A straightforward means of addressing this requirement is to obtain a data plan that supports a Public and Static IP address. There are other ways to address your mobile terminate requirements, as well as manage device and data security on the cellular networks. We recommend discussing these options with a mobile operator or one of our MVNO (Mobile Virtual Network Operator) partners to arrive at the most efficient solution for you and your customers.

Wireless Mobile Operators and Modem Approvals

Multi-Tech's cellular modems are approved by regulatory agencies and mobile operators and considered complete end-product modems. When embedding a Multi-Tech cellular modem, the OEM must follow design recommendations in our Universal Developer Guide to maintain operator certification of the modem. This includes antenna system recommendations. When using an integrated modem, certain mobile operators may require the OEM to demonstrate network compliance of their application; which might require additional testing.

The table below lists the industry requirements against which Multi-Tech modems have been approved and the Mobile Operator networks on which Multi-Tech has been certified. It also outlines any additional OEM actions that are required to take a device to market.

GSM Cellular Technology

Mobile Operator	Industry Certification	Carrier Certified	SocketModem OEM Approval Requirements	MultiModem OEM Approval Requirements
AT&T	FCC & PTCRB	Yes	None	None
T-Mobile	FCC & PTCRB	None Required	None	None
Rogers Wireless	IC & PTCRB	Yes	Yes, Product Notification	None
Jasper Wireless	FCC & PTCRB IC & GCF	None Required	None	None
Other GSM	GCF & CE	None Required	None	None

CDMA Cellular Technology

Mobile Operator	Industry Certification	Carrier Certified	SocketModem OEM Approval Requirements*	MultiModem OEM Approval Requirements
Aeris	FCC, CDG 1 & CDG 2	Yes	None	None
Bell Mobility	IC, CDG 1 & CDG 2	Yes	Yes, Product Testing	None
Sprint	FCC, CDG 1 & CDG 2	Yes	None	None
Telus	IC, CDG 1 & CDG 2	Yes	None	None
Verizon	FCC, CDG 1 & CDG 2	Yes	None	None

* If support is desired by a network, approval testing may be necessary.

Mobile Virtual Network Operators

A Mobile Virtual Network Operator (MVNO) is essentially a Mobile Operator that does not own its own spectrum, but has its own network infrastructure. MVNOs focus on enabling customers with data communications over cellular networks. A Mobile Virtual Network Enabler (MVNE) provides services to MVNOs, like provisioning and billing. Multi-Tech has partnered with the leading MVNOs and MVNEs to provide design and implementation expertise for quick activation of customer solutions.

MVNO	GSM (US)	CDMA	Static IP	Dev Kit	SMS Plans	Intl. Coverage	Device Monitoring Tools	Website
CrossBridge Solutions	AT&T	Sprint	Yes	Yes	Yes	Roam	Advanced	Crossbridgesolutions.com
KORE Telematics*	AT&T	Verizon	Yes	Yes	Yes	Yes	Advanced	Koretelematics.com
nPhase	AT&T	Verizon/ Vodafone	Yes	Yes	Yes	Roam	Advanced	nphaseM2M.com
Numerex*	All Global GSM Carriers	Sprint, US Cellular	Yes	Yes	Yes	Numerex Worldpass™	Advanced Software Platforms	Numerex.com
Wyles*	T-Mobile	Sprint	Yes	Yes	Yes	Yes	Advanced	Wyles.com

* Considered an MVNE

Multi-Tech Products Overview

All Multi-Tech solutions are carrier approved and ready-to-integrate. The MultiModem® line of cellular modems and routers provide the quickest way to get to market. Multi-Tech's SocketModem® embedded modems are approved as end solutions by carriers, providing a quick-to-market option for higher volume new products and a cost-effective migration path for next generation products.

	Interfaces	GSM & CDMA Cellular Technologies	Intelligent Models*	Models with GPS
Cellular Development Platform	Serial + USB + Ethernet + GPIO	2G & 3G	OpenEmbedded Linux development environment	X
MultiModem® rCell (router)	Serial + Ethernet	2G & 3G	NAT + TCP/IP	X
MultiModem® iCell	Serial + USB + GPIO	2G & 3G	Universal IP	X
MultiModem® Cell	Serial -or- USB	2G	Limited TCP/IP stack	
SocketModem® iCell	Serial -or- Serial + USB	2G & 3G	Universal IP	X
SocketModem® Cell	Serial	2G	Limited TCP/IP stack	
MultiConnect™ AW (analog-to-wireless converter)	Serial	2G GSM	Analog to IP	

* The intelligent embedded operating system of select Multi-Tech modems and routers provides enhanced functionality for mission critical applications for which automatic/persistent connectivity is needed. Multi-Tech's Universal IP® provides a consistent development interface, which allows developers to write a unique host application with freedom to select from a growing number of communications technologies, essentially future-proofing customer solutions.



About Multi-Tech Systems

Multi-Tech Systems, Inc., is a global manufacturer of award-winning external and embedded modems and Unified Communications products that connect data over cellular and analog networks from anywhere in the world. As a leader in the industry for 40 years, Multi-Tech's reputation for reliability and innovative design is evident with 80+ patents, 20+ million devices being used by thousands of customers worldwide and certifications from more than 30 carriers and over 80 countries.

- Founded 1970, privately held
- Headquarters in Mounds View, Minnesota, USA
- 50,000 square foot state-of-the-art electronic component assembly and testing facility
- Products designed and manufactured in Minnesota with U.S. and non-U.S. components
- RoHS (Restriction of Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment) compliant
- ISO 9001:2008, UL, CSA, CE certifications
- Worldwide reputation for quality and reliability
- Knowledgeable and responsive support team

Solution Overview

The shortest path to wireless communications starts with Multi-Tech solutions.

Device Networking

Cellular Modems, Analog Modems, SMS Servers

- Quick-to-market
- Carrier, regulatory and global approvals

Wireless Converter

- Analog-to-wireless converter
- Extends life of legacy device

Cellular Development Platform

All-in-one Hardware and Open Source Linux Development Environment

Embedded Device Networking

Embedded Cellular and Analog Modems, Embedded Device Servers

- Interchangeable socket devices
- Easy migration to future networks
- Carrier and regulatory approvals

Unified Communications

Fax Servers and Voice over IP Gateways

- Quick ROI
- Cost-effective and reliable

Services & Support

Engineering, Design, Development, Manufacturing and Support

World Headquarters
Tel: (763) 785-3500
(800) 328-9717
www.multitech.com

EMEA Headquarters
Multi-Tech Systems (EMEA)
United Kingdom
Tel: +(44) 118-959 7774