

3.2.2 Operational Characteristics

The modem shall provide the operational characteristics defined in the following paragraphs.

3.2.2.1 Communications

3.2.2.1.1 Normal Data Mode

During normal operation, the modem serial interface shall be directly connected to the i30 card. The modem shall provide all i30 circuit switched, and packet data communication features, as described in the Mobile Subscriber DTE./DCE Interface for Data Services. The modem shall operate identically to an i30sx phone tethered through an NKN6544A accessory data cable. The modem shall default to the Normal Data mode unless one of the other modes (Gateway or AVL) has been initialized through the modem's diagnostic menu.

3.2.2.1.2 Gateway Data Mode

The modem shall also be configurable for operation as a gateway device. In this mode, the modem shall receive basic serial data from the user port, encapsulate it into UDP or TCP packets, and send it out over the iDEN packet data network to a pre-defined IP address. Similarly, the modem shall receive appropriately addressed packets from the iDEN network, parse the data, and send it to the user via the serial port. The modem shall also provide a lookup table for translation of Bristol Babcock BSAP addresses into IP addresses in order to seamlessly route BSAP communications traffic over the iDEN packet data network. In addition, the Gateway Data mode shall support the Hayes Compatible AT mode dial command (ATD) as defined in the iO1000 developer's guide. Gateway data mode initialization shall be accomplished through the modem's diagnostic menu. Once initialized, the Gateway mode shall become the default, with all settings retained in non-volatile memory.

3.2.2.1.3 Automatic Vehicle Location (AVL) Mode

The modem shall also be configurable for operation as an AVL device. In this mode, the modem shall periodically "read" position information from the internal GPS receiver and external I/O interface, encapsulate it into UDP or TCP packets, and send it out over the iDEN packet data network to a pre-defined IP address. Alternately, the modem shall also be capable of receiving appropriately addressed GPS request messages from the iDEN packet data network, and reply with the requested GPS or external I/O information. The modem shall maintain a non-volatile revolving history of this information, providing a "store and forward" capability for periods of iDEN network coverage loss. In future firmware revisions, the modem shall also have the ability to go to "sleep" (drawing minimal current from the vehicle battery), wake itself up after a configurable interval, send its current GPS location, and then go back to "sleep". AVL mode initialization shall be accomplished through the modem's diagnostic menu. Once initialized, the AVL mode shall become the default, with all settings retained in non-volatile memory.

3.2.2.1.4 Direct Connect? Voice Communications

The modem shall support the use of an external PTT microphone accessory to enable Direct Connect? voice services. The modem shall provide operating power for the external microphone as well as the analog audio and digital data and control signals necessary to support the voice services and to allow

the user to browse and select from the contact listings stored in the modem's SIM card. Contact listings shall be created or maintained either through one of Nextel's existing address book administration services, or through direct entry via the PTT mic. Firmware required to support PTT mic shall not be part of the initial release of the iR1600.

3.2.2.1.5 Access Control List

The modem shall provide a user configurable access control list (ACL) which shall include both a range and an individual listing of up to 30 IP addresses. Communications to the modem, will be restricted to those IP addresses contained in the ACL. The ACL shall function in Gateway and AVL operating modes only. It shall have no effect on Normal mode operation.

3.2.2.1.6 Encryption

The modem shall provide user configurable encryption/ decryption of iDEN network data. This encryption shall employ a standard 128 bit AES algorithm with an eLutions proprietary security protocol. Encryption shall function in Gateway and AVL operating modes only. It shall have no effect on data transmitted or received in Normal mode.

3.2.2.1.7 Over-The-Air Configuration/ Upgrade

The modem shall support remote over-the-air (OTA) configuration and firmware upgrade, initiated by a centralized server. Utilization of this feature shall be limited to modems operating in the AVL or Gateway modes, and activated with public IP addresses. Private IP addresses may be utilized if the upgrade server is also on the iDEN network. For modems operating in Normal mode or with inaccessible IP addresses, the modem user may initiate an OTA upgrade connection, to a pre-defined server IP address, by pressing the master reset pushbutton and holding it for 5 seconds.

3.2.2.1.8 RF Characteristics

All modem communications shall provide the following RF operational characteristics.

Power :	600mW typical
Frequency Range :	Tx 806-825 MHz, Rx 851-870 MHz
Channel Spacing	25 KHz
Channel Access :	TDMA
Network Protocol :	iDEN

3.2.2.2 Power-Up/Down

If ignition sense is utilized, the modem shall power-up when the vehicle's engine is started. The modem microcontroller shall automatically power-up the i30 board and turn over the communications interface to the user serial data connector. When the vehicle's engine is stopped, the microcontroller shall de-register the i30 and wait approximately 5 seconds before powering down the modem. If ignition sense is externally bypassed, the microcontroller shall power-up the modem immediately upon application of 12V input power. The modem shall power-down immediately upon loss of 12V input power without de-registering from the network.

3.2.2.3 Resets

During normal operation, the modem's microcontroller shall continuously monitor the soft and master reset pushbuttons. When pressed, the microcontroller shall perform the corresponding reset of the i30 card, as defined in the RALP document.

3.2.2.4 LED Status Indication

3.2.2.4.1 IDEN Network Status

The bi-color iDEN network status LED shall provide the following indications.

Color	Indication
Blinking Red	Registering – modem is connecting to the iDEN network
Solid Red	Out-Of-Range – modem is not able to connect to the iDEN network
Blinking Green	In-Range – modem is connected to the iDEN network
Solid Green	In Use – iDEN network communications is in progress (circuit switched only)
Off	Off – vehicle ignition is off or loss of 12V input power

3.2.2.4.2 EIA-232 Status

The six EIA-232 single color status LEDs shall provide the following indications.

Signal	Color	Indication
TX	Green {Off}	Modem is transmitting {not transmitting} data to the user (host) system
RX	Green {Off}	Modem is receiving {not receiving} data from the user (host) system
RTS	Green {Off}	Request to send (from user host system) is asserted {not asserted}
CTS	Green {Off}	Clear to send (from modem) is asserted {not asserted}
DTR	Green {Off}	Data terminal equipment (user host system) is ready {not ready}
DSR	Green {Off}	Modem is ready {not ready}

3.2.2.4.3 Mode Indication

The three single color mode LEDs shall indicate the modem's operating mode as follows.

Left LED	Middle LED	Right LED	Indication
Red	Off	Off	AVL Mode
Off	Red	Off	Normal Mode
Off	Off	Red	Gateway Mode
Off	Off	Off	Diagnostic Mode

3.2.2.5 Field Support/ Diagnostics

The modem microcontroller shall continuously monitor the diagnostic interface connector and detect when a laptop PC is plugged in. The microcontroller shall then transmit a HyperTerminal menu screen

to the laptop offering field support personnel various diagnostic functions that the microcontroller can perform on the i30 card, via its AT or RALP command set. The microcontroller shall stay in this diagnostic mode until the PC is unplugged from the diagnostic interface. The diagnostic menu shall provide the following functions.

Menu Selection	Function
1 Reset	Performs soft reset via RALP commands
2 Master Reset	Performs master reset via RALP commands
3 Signal Quality	Sends AT+WS53? (SQE) command
4 Signal Strength	Sends AT+WS50? Command
5 Packet Data Registration Information	Sends AT+WPSTATE command
6 Channel Information	Sends AT+WPCHANINFO command
7 Stored Parameters	Sends AT&V command
8 DNS IP Address	Sends AT+WV342?
9 Modem Pass-Thru Mode	Allows user entry of any supported AT command
0 iR1600 Firmware Update	Allows user update of iR1600 firmware
i Radio Information	Provides SIM ID and IMEI via RALP
d Deregister From IP Network	Sends AT+WPDEREG command
r Register With IP Network	Sends AT+WPREG command
h iR1600 Configuration Data	Provides iR1600 build configuration information
g GPS Status	Provides latitude/longitude position information
m iR1600 Operating Mode	Allows for verification and configuration of iR1600 operating mode (Normal, Gateway, AVL)
e External I/O Configuration ¹	Allows for configuration of the modem's external I/O discretes ¹

Note 1. Not supported in the initial release of the iR1600 firmware.

3.2.2.6 GPS Receiver

The optional GPS receiver shall be a standard L1 frequency, 8-channel, continuous tracking receiver, with 32 correlators. The receiver shall provide the following operational characteristics.

Data Protocol :	NMEA 0183 v3.0
Update Rate	2 seconds
Baud rate :	4800
Byte Format :	8 data bits No parity 1 stop bit No flow control
Messages Provided :	GGA, VTG, GLL, ZDA, GSA, GSV, RMC

Cold Start Time :	<90 sec. (50%), <170 sec. (90%)
Warm Start Time :	<38 sec. (50%), <45 sec. (90%)
Horizontal Accuracy :	<6 meters (50%), <9 meters (90%)
Altitude Accuracy :	<11 meters (50%), <18 meters (90%)