# InfoWave™ Specifications

InfoWave is a direct-sequence spread-spectrum data modem. It can be customized to operate in frequency bands of 902-928 MHz or 2.4-2.4835 GHz at data rates of 85, 96, 192 or 250 kbps. An 85 kbps version of InfoWave has been certified by FCC and Industry Canada for unlicensed operations in the ISM frequency (902-928 MHz) band.


**Features**

- 902-928 MHz or 2.4-2.4835 GHz ISM Bands
- Digital direct-sequence spread-spectrum technology
- Serial port (RS-232) for easy host interface
- Point-to-point or point-to-multipoint applications
- Simple command set for fast system integration
- Air data rate at 85, 96, 192, or 250 Kbps
- Auto-scan to select clearest channel
- Auto-channel change in the presence of interference
- Programmable PN code
- HDLC-like data link protocol for error control and flow control
- Adjustable packet size for optimum throughput

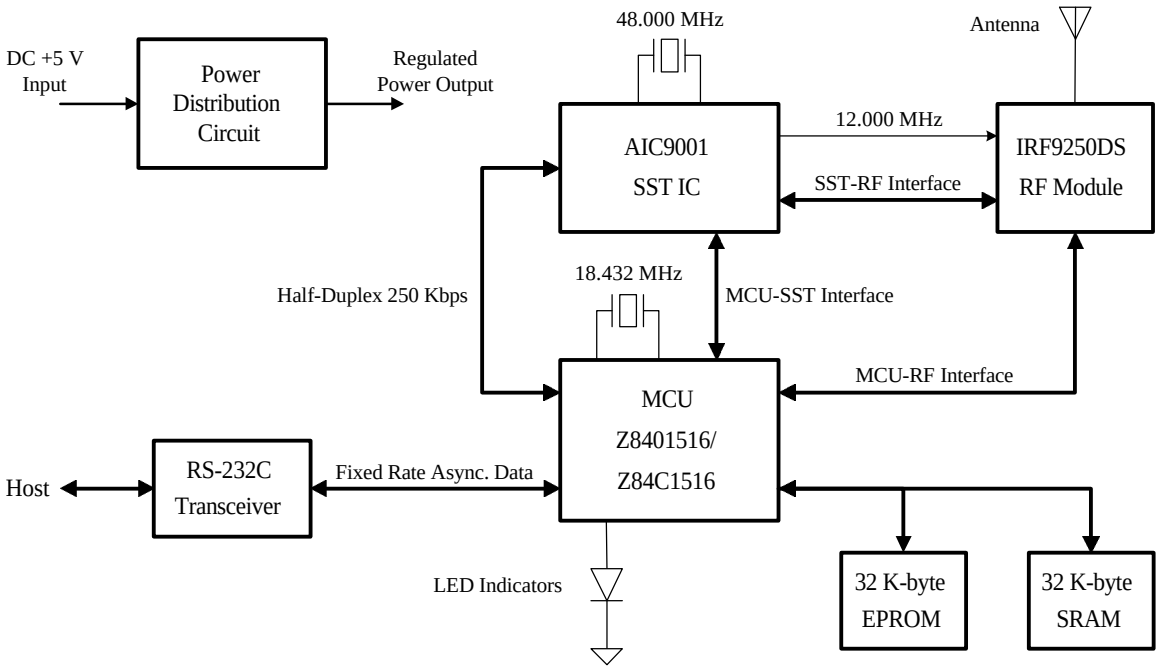
## Specifications

| **Model** | **IW9006-96 / -192 / -250** | | **IW2406-96 / -192 / -250** | |
|---|---|---|---|---|
| **Transceiver** | | | | |
| Frequency Band | 902 ~ 928 MHz | | 2.4 ~ 2.5 GHz | |
| Modulation | GMSK | | GMSK | |
| Output Power | 100 mW | | 100 mW | |
| Data Interface | Synchronous | | Synchronous | |
| Data Rate | 85 / 96 / 192 / 250 kbps | | 96 / 192 / 250 kbps | |
| Number of Channels | 10 / 10 / 5 / 4 | | 33 / 16 / 13 | |
| Sensitivity@ BER=$1*10^{-5}$ | -98 /-98 / -95 / -93 dBm | | -98 / -95 / -93 dBm | |
| Distance (open space) | 800 / 800 / 600 / 400 feet | | 360 / 270 / 180 feet | |
| Power Supply | DC 4.7 V ~ 5.5 V | | DC 4.7 V ~ 5.5 V | |
| Power Consumption | Transmit | 160 mA | Transmit | 160 mA |
| | Receive | 100 mA | Receive | 100 mA |
| | Standby | <200 µA | Standby | < 200 µA |
| Size | 48mm x 78mm x 15mm | | 48mm x 78mm x 15mm | |

| **Host Interface** | | |
|---|---|---|
| Host Interface Type | RS-232 Async. Serial | |
| Host Interface Flow Control | RTS/CTS Hardware | |
| Host Interface Data Rate | Up to 115.2 kbps | |
| Host Interface Auto Baud | Yes ( 9600 ~ 115200 ) | |
| Host Interface Command Set | WM Command Set | |
| Power Supply | DC 4.7 V ~ 5.5 V | |
| Power Consumption | Transmit | 250 mA |
| | Receive | 190 mA |
| Size | 120mm x 83mm x 15mm | |
| Weight | 7.8 oz | |
| Operating Temperature Range | -20° C ~ +60° C | |
| Storage Temperature Range | -40° C ~ +80° C | |

# InfoWave™ Block Diagram

The InfoWave system consists of three key components: the RF module, spread-spectrum baseband transceiver chip (SST IC) and micro-controller (MCU) unit. The data rates and operating frequencies can be customized for different requirements. The following block diagram shows a 250 kbps InfoWave system.



# InfoWave™ Command Set

InnoMedia Wireless Group offers a “WM” command set for the InfoWave spread-spectrum data modem and development tools. This command set allows users to rapidly develop wireless prototypes and applications before going through lengthy hardware development cycles.

Each command is prefixed by two letters “WM”, followed by some other characters as parameters, and then ended by a carriage return <CR>. Please note that these commands can only be used in the Data Communication Equipment (DCE) mode. This command set is not supported in the Data Terminal Equipment (DTE) mode.

**Definitions:**

- Point-to-Point Connection: InfoWave only supports one point-to-point connection at a time. A polling or inquiry scheme is needed to implement point-to-multipoint communication.
- Primary Station: The station that initiates a connection.
- Secondary Station: The station that communicates with a Primary station.
- My Address: The address of the local station.
- Partner Address: The address of the remote station.
- Default Baud Rate: The baud rate used by the RS-232 interface at a Secondary Station.
- Auto-Channel Scan: InfoWave will automatically scan all the available RF channels and record the interference level of each channel after a power-up initialization.
- Auto Channel Change: InfoWave will automatically choose a clear channel if any interference occurs and disturbs the data transmission during a radio connection.
- Group ID: Each station has a Group ID and can only communicate with other stations with the same Group ID.
- PN Code: Pseudo-random (PN) code used by InfoWave that is a direct-sequence spread-spectrum communication system. InfoWave™ has 20 sets of PN codes. This allows two sets of InfoWave to operate in close proximity by choosing different PN codes.
- Create_Link Time Constant: After receiving set-up link command, a Primary Station continuously tries to create a radio link with a Secondary Station for a "CREATE_LINK” duration. If the timer times out and the Primary Station still could not find the target Secondary Station, Primary Station will get a message as “Partner Not Found”.
- Both_Idle Time Constant: If a radio link is established and there is no data to be sent between two stations for a “BOTH_IDLE” period, the radio transmission power will automatically be turned off. Whenever any station has data to send, the radio will turn

on again. This avoids mutual interference if there are more than one set of InfoWave located in close proximity.

## WM Command Set

Note that the command could be entered in low or upper case.

| Command | Description |
|---|---|
| WMA | Query the setting of auto channel scan function. |
| WMAx | Set up the auto-channel scan function. x=’0’ : Disable scan channel,, x=’1’ : Enable scan channel. |
| WMB | Query the setting of default baud rate. |
| WMBx | Set up the default baud rate. x=’1’ : 115200 , x=’2’ : 57600 , x=’3’ : 38400 , x=’4’ : 19200 , x=’5’ : 9600. |
| WMC | Query the setting of auto channel change function. |
| WMCx | Set up the auto channel change function. x=’0’ : Disable auto change , x=’1’ : Enable auto change. |
| WMD | Disconnect the radio link established previously. |
| WME | Query the setting of echo and response function. |
| WMEx | Set up the echo and response function. x= ’A’ ~ ‘P’. For detailed definition, see Table 2. |
| WMF | Query the setting of number of maximum bytes in one packet. |
| WMFxxxx | Set up the number of maximum bytes in one packet. xxxx cannot exceed a 4-digit decimal number ranging from 1 to 1024. |
| WMI | Query the setting of group ID. |
| WMIxxxxxx | Set up the group ID. xxxxxx must be exactly a 6-digit hexadecimal number. A station can only communicate with other stations with the same Group ID. |
| WMJ | Query station name. |
| WMJxxx… | Set up the station name to be xxx…. The length of xxx… cannot exceed 31 characters and it can not contain ‘$’. |
| WML | List current setting of important parameters. The format is as follows:<br>Version=InfoWave.VG0<br>Date=05-15-1999<br>PN4=B386A45E5F670D4848BECE1A1A917D9C<br>ID=010203<br>My Address=1<br>Maximum Frame Length=512<br>Echo=ON<br>Response=ON<br>Auto Scan Channel=On<br>Auto Channel Change=On<br>Current RF Channel=8 |

| | |
|---|---|
| | Type of RS232 Port=DCE<br>Current Baud Rate=115200<br>Default Baud Rate=115200<br>Wireless Link=Disconnected<br>Identification Name=INNOMEDIA TECHNOLOGY INC . |
| WMM | Query the setting of my address. |
| WMMxxx | Set up my address. xxx can not exceed a 3-digit decimal number ranging from 1 to 254. |
| WMN | Switch to data mode from command mode. |
| WMO | Query the stored partner's PN code |
| WMOxx | Temporarily set the local PN code to the partner's PN code. xx cannot exceed a 2-digit decimal number ranging from 1 to 20. |
| WMP | Query the setting of PN code of local station. |
| WMPxx | Set up the PN code of local station. xx cannot exceed a 2-digit decimal number ranging from 1 to 20. |
| WMRxy | Set up the baud rate and data format of the RS-232 interface of remote station. x='A' ~ 'O', y='1' ~ '5'. For detailed definition, see Table 3. |
| WMSxxx | Create a radio link with a partner addressed by xxx . xxx cannot exceed a 3-digit decimal number ranging from 1 to 254. Once the radio link is established, the InfoWave™ switches from command to data mode. A ESCAPE sequence can return the InfoWave™ to the command mode. The ESCAPE sequence consists of three contiguous '\|' characters and a <CR>. |
| WM&Bxxx | Set up the BOTH_IDLE time constant in units of minute. xxx cannot exceed a 3-digit decimal number ranging from 0 to 255. If x=0, the BOTH_IDLE timer is disabled. |
| WM&Cxxx | Set up the CREATE_LINK time constant uniting in second. xxx cannot exceed a 3-digit decimal number ranging from 0 to 255. If x=0, the CREATE_LINK timer is disabled. |
| WM&0 | Restore the default setting. |

Table 1. The WM Command Set Used by the Asynchronous Interface

| | Save setting to EEPROM or not<br>0: Don't Save<br>1: Save | Echo control<br>0: Echo On<br>1: Echo Off | Response control<br>0: Response On<br>1: Response Off | Text or numerical response selection<br>0: Text Response<br>1: Numerical Response |
|---|---|---|---|---|
| WMEA | 0 | 0 | 0 | - |
| WMEB | 0 | 0 | 1 | 0 |
| WMEC | 0 | 0 | 1 | 1 |
| WMED | 0 | 1 | 0 | - |

| | | | | |
|---|---|---|---|---|
| WMEE | 0 | 1 | 0 | - |
| WMEF | 0 | 1 | 1 | 0 |
| WMEG | 0 | 1 | 1 | 1 |
| WMEH | 1 | 0 | 0 | - |
| WMEI | 1 | 0 | 0 | - |
| WMEJ | 1 | 0 | 1 | 0 |
| WMEK | 1 | 0 | 1 | 1 |
| WMEL | 1 | 1 | 0 | - |
| WMEM | 1 | 1 | 0 | - |
| WMEN | 1 | 1 | 1 | 0 |
| WMEO | 1 | 1 | 1 | 1 |
| WMEP | Restore previous setting | | | |

Table 2. The Definition of WMEx Command

| x | Data Format | y | Baud Rate |
|---|---|---|---|
| A | 7 + N + 1 | 1 | 115200 |
| B | 7 + E + 1 | 2 | 57600 |
| C | 7 + O + 1 | 3 | 38400 |
| E | 7 + N + 2 | 4 | 19200 |
| F | 7 + E + 2 | 5 | 9600 |
| G | 7 + O + 2 | | |
| I | 8 + N + 1 | | |
| J | 8 + E + 1 | | |
| K | 8 + O + 1 | | |
| M | 8 + N + 2 | | |
| N | 8 + E + 2 | | |
| O | 8 + O + 2 | | |

Table 3. The Definition of WMRxy Command

| | **Length (Byte)** | **Type** |
|---|---|---|
| Firmware Version | 12 | ASCII |
| Firmware Revised Date | 4 | Binary |
| Station Name | 32 | ASCII |
| PN Code | 16 | Binary |
| Group ID | 3 | Binary |
| My Address | 1 | Binary |

| | | |
|---|---|---|
| Max Frame Length | 2 | Binary |
| Current Baud Rate | 1 | ASCII |
| Default Baud Rate | 1 | ASCII |
| Channel Number | 1 | Binary |
| Flag1 | 1 | Binary |
| Flag2 | 1 | Binary |

Table 4. The Data Structure of Numerical Response of WML Command

| **Flag1** | **Description** | **Definition** |
|---|---|---|
| Bit 0 | Numerical or Text Response | 1 : Numerical Response , 0 : Text Response. |
| Bit 1 | Response Control | 1 : Response On , 0 : Response Off. |
| Bit 2 | Echo Control | 1 : Echo On , 0 : Echo Off. |
| Bit 3 | Save to EEPROM | 1 : Save , 0 : Don't Save. |
| Bit 4 | Auto Scan Channel Control | 1 : Enabled , 0 : Disabled. |
| Bit 5 | Auto Channel Change Control | 1 : Enabled , 0 : Disabled. |
| | | |
| **Flag2** | **Description** | **Definition** |
| Bit 0 | RF Link Status | 1 : Connected , 0 : Disconnected. |
| Bit 1 | Asynchronous Interface Type | 1 : DTE , 0 : DCE. |

Table 5. Definition of Flag1 and Flag2

Note that the timing of issuing the Escape Sequence is important, which is shown below.

"|" ← T1 → "|" ← T1 → "|" ← T2 → <CR> ← T3 → "Next WM Command"
T1 < 500 ms
T2 < 800 ms
50 ms < T3

Table 6 shows the detailed information of responses of all commands. Please note that the strings enclosed by " " are ASCII characters. In contrast, the number prefixed by 0x is a binary number. Another thing is that "2x" denotes 2-byte ASCII characters, "3x" denotes 3-byte ASCII characters, and so on.

| | **Command** | **Condition** | **Numerical Response** | **Text Response** |
|---|---|---|---|---|
| 1 | WMA | | "x" | "x"<br>"OK" |

| | | | | |
|---|---|---|---|---|
| | WMAx | Disconnected | “0” | “OK” |
| | WMAx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 2 | WMB | | “x” | “x”<br>“OK” |
| | WMBx | Disconnected | “0” | “OK” |
| | WMBx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 3 | WMC | | “x” | “x”<br>“OK” |
| | WMCx | Disconnected | “0” | “OK” |
| | WMCx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 4 | WMD | Connected | “0” | Pause<br>“Disconnected !”<br>“OK” |
| | WMD | Disconnected | “0” | “Disconnected !”<br>“OK” |
| 5 | WME | | “x” | “x”<br>“OK” |
| | WMEx | | “0” | “OK” |
| | WMEx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 6 | WMF | | “4x” | “4x”<br>“OK” |
| | WMFx | Disconnected | “0” | “OK” |
| | WMFx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 7 | WMH | | “x” | “x”<br>“OK” |
| | WMHx | Disconnected | “0” | “OK” |
| | WMHx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 8 | WMI | | “6x” | “6x”<br>“OK” |
| | WMIx | Disconnected | “0” | “OK” |
| | WMIx | Connected | “N” | “Can not set parameter during radio connection.” |

| | | | | |
|---|---|---|---|---|
| | | | | “OK” |
| 9 | WMJ | | “31x” | “31x”<br>“OK” |
| | WMJx | Disconnected | “0” | “OK” |
| | WMJx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 10 | WML | | See Table 4 | “Version=InfoWave.VG0”<br>“Date=05-15-1999”<br>“PN4=B386A45E5F670D4848BECE1A1A917D9C”<br>“ID=010203”<br>“My Address=1”<br>“Maximum Frame Length=512”<br>“Echo=On”<br>“Response=On”<br>“Auto Scan Channel=On”<br>“Auto Channel Change=On”<br>“Current RF Channel=8”<br>“Type of RS232 Port=DCE”<br>“Current Baud Rate=115200”<br>“Default Baud Rate=115200”<br>“Wireless Link=Disconnected”<br>“Identification Name=INNOMEDIA TECHNOLOGY INC”<br>“OK” |
| 11 | WMM | | “3x” | “3x”<br>“OK” |
| | WMMx | Disconnected | “0” | “OK” |
| | WMMx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 12 | WMN | Connected | “0” | “OK” |
| | WMN | Disconnect | “7” | “No Connection !”<br>“OK” |
| 13 | WMO | | “2x” | “2x”<br>“OK” |
| | WMOx | | “0” | “OK” |
| 14 | WMP | | “2x” | “2x”<br>“OK” |
| | WMPx | Disconnected | “0” | “OK” |
| | WMPx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 15 | WMRxy | | “0” | “OK” |

| | | | | |
|---|---|---|---|---|
| 16 | WMS | Disconnected | 0x00 (one-byte binary number) | “Disconnected !”<br>“OK” |
| | WMS or WMSx | Connected with address x (x is the current partner) | x (one-byte binary number) | “Connected with address x”<br>“OK” |
| | WMSx | Create a new wireless link and it is done successfully | “0” | “Connecting…..”<br>pause<br>“Connect to Address x”<br>enter data mode |
| | WMSx | Create a new wireless link, but the desired partner not found | “D” | “Connecting…..”<br>pause<br>“Partner Not Found !”<br>“Disconnected !”<br>“OK” |
| | WMSx | Create a new wireless link, but the desired partner is busy | “E” | “Connecting…..”<br>pause<br>“Partner Busy !”<br>“Disconnected !”<br>“OK” |
| 17 | WM&B | | “x” | “x”<br>“OK” |
| | WM&Bx | Disconnected | “0” | “OK” |
| | WM&Bx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 18 | WM&C | | “x” | “x”<br>“OK” |
| | WM&Cx | Disconnected | “0” | “OK” |
| | WM&Cx | Connected | “N” | “Can not set parameter during radio connection.”<br>“OK” |
| 19 | WM&0 | | “0” | “OK” |
| 20 | Invalid command | | “Z” | “WM_ERROR” |
| 21 | “|||“ <cr> Escape sequence | Data mode | “0” | “OK” |

Table 6. Responses of WM Command Set