



iDEN Data Module iO1500R

Application and Integration

Developers Guide

Release 1.3 May 15, 2003

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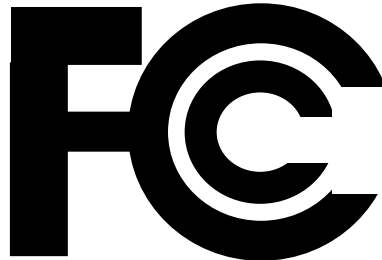
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68P02954C65-O

DECLARATION OF CONFORMITY

Per FCC CFR 47 part 2 Section 2.1077(a)



Responsible party name: Motorola Inc.
Address: 8000 West Sunrise Boulevard,
Plantation, FL 33322 USA
Phone number: 1 (800) 453-0920

Hereby declares that the product:

Product name: iO1500R
Model Number: F2572A
FCC ID: AZ492FT5826

Conforms to the following regulation:

FCC Part 15, subpart B
Class B Computer Peripheral Device

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Date: MAY 15, 2003

DECLARATION OF CONFORMITY	2
Revision History	5
Purpose Of This Document.....	5
Distribution	5
Related Documentation.....	5
Module Descriptions and Specifications.....	6
iO15 Modem Product Specifications	6
Electrical specifications:	6
Environmental Specifications	6
Other Specifications.....	6
iO1500R Evaluation board.....	7
Safety Notice - ATTENTION	7
FCC Regulation - Letter of Notice.....	7
iO1500R Hardware Interfacing Information.....	8
Mechanical Dimensions.....	8
Connector Types:	9
Accessory Connector Pin Functions	10
Status LED Indications	12
Voice Support	12
Design Considerations For iO1500R OEM Developers	13
Hardware Considerations.....	13
Software Considerations	13
Module Software And Interface Modes	14
Circuit Switched Data	14
Packet Data	14
Managing User Image Profiles	15
Warning When Switching User Image Profiles.....	15
Setting The Active User Image.....	15
Properly configuring, saving, and restoring user image profiles.....	16
Changing the settings of a user image	16
Restoring the settings of a saved user image	16
How To Use Hayes Compatible Packet Data mode.....	17
How to use Hayes Compatible Packet Data mode (Continued)	19
Other Useful AT Commands	19
Reset, Master Reset, Power off.....	20
AT Command To RESET the iO1500R.	20
AT Command For Master Reset.....	20
AT Command To Power the iO15 off.	20
SIM AT commands,.....	20
AT Command To Unlock the iO15 SIM card.	20
AT Command To enable or disable the SIM PIN lock mechanism.	21
Other useful iO15 AT commands.....	21
Service Status Log (SSL) AT command.....	21
PC Applications To Control the iO1500R.....	22
FVN4780A - iDEN module - Packet Data Applet.....	22
Status Program.....	22
Configuration Program	22
Service Program.....	22
iDEN data modules – Software integration.....	23

Additional Information For Registering and Going Offline	25
Module Activation and Registration.....	25
To make the iO1500R module re-register perform these steps:	25
Monitoring The RS232 CD pin and Going Offline:	25
Packet Data Status Information Command.....	26
IP Address/ Network Entity Identifier (NEI) Command	27
Summary Of AT Commands.....	28
General AT Commands.....	28
User Image Profile Management Commands	28
Hayes Compatible Packet Data Commands	28
Registration, Reset, and power off Commands.....	28
SIM card management Commands	28
Network Status Commands	29
Appendix A: Requirements For FCC Testing	30

Revision History

Date	Revision	Comments
May 5, 2003	1.3	Initial Release.

Purpose Of This Document

This guide is for the application developer and system integrator who plan to use the iO1500R iDEN data module in their design of an OEM product. This manual describes the requirements and interfaces for the integration of the iDEN iO1500R wireless module into OEM terminal/equipment. These requirements include instructions for FCC testing, requirements for use with wireless carriers, setup instructions, pin descriptions, available software, useful AT commands, and design considerations. This document also covers how to use the iO1500R via Hayes Compatible Packet Data mode with older legacy equipment whose software cannot support packet data.

Distribution

This manual will be distributed to the developer on a CD or will be obtainable from the iDEN Developers web site. This document will refer to related documents and software, which can aid the OEM designer in integrating the iO1500R into their product.

Related Documentation

iO1500R Brochure

FCC iO1500R approval (See Appendix A for instructions on how to retrieve it).

OEM Evaluation Board User's Guide 68P02954C85-O

iDEN Mobile Subscriber DTE/DCE Interface for Data Services 68P81129E10-C

iDEN Data Module iO1500R Application and Integration Developers Guide - 68P02954C65-O, this document.

Note: Please review iDEN technology using the

iDEN Technical Overview – Notes On The iDEN System – 68P81095E55-A

Related Software: **iDEN module - Packet Data Applet - FVN4780A**

For more information about iDEN subscribers and technology go to the iDEN site at <http://www.mot.com/LMPS/iDEN>

Module Descriptions and Specifications

The iO1500R module for iDEN is a wireless subscriber device for providing packet data and circuit data connectivity over the iDEN 800MHz infrastructure.

The module is supported by PC applications for installation, monitoring, service and development for the OEM and the system integrator.

iO1500R Module Product Specifications

Electrical specifications:

Frequency	TX 806-825 MHz RX 851-870 MHz
TX Output Power	Average 0.6 watts at nominal 3.6V & 25 °C
Input Voltage	3.6VDC +/- 5 % ripple 50mv
Current Consumption	Standby Current avg. 20mA Tx Current in slot Avg. 1:6 1000mA Max Rx Current in slot Avg. 1:6 100 mA Max
Tx. Modulation	
Circuit Data / Voice	Quad -16 QAM;
Packet Data	Quad-64 QAM, Quad-16 QAM and QPSK;
Trans. ACCPR	-60 dB @ 25 KHz -74.5 dB @ 1000 KHz
Static Rx Sensitivity	-111 dBm @ -10% BER

Environmental Specifications

Operating Temp	-25°C to 60°C
Storage Temp	-40°C to 85°C
Humidity:	95% RH @ 50°C , non condensing
Vibration:	Sine TIA/EIA 603 Para. 3.3.4
Shock	TIA/EIA 603 Para. 3.3.5

Other Specifications

Size	85.6 X 57.7 X 6.0mm
Weight	30 grams

For module description, features and specifications refer to the iO1500R brochure or get the information from the WEB at <http://ml800.motorola.com/>=>Module Modems => iO1500R.

iO1500R Evaluation board

The evaluation board helps the developer and system integrator to start development of the software before their terminal hardware is ready. The developer can connect a PC to the evaluation board and communicate with the iO1500R that is registered to the system and work over the iDEN infrastructure. For more information see the OEM Evaluation Board User Guide 68P02954C85-O.

Safety Notice - ATTENTION



This iDEN iO1500R Module is restricted to occupational use only to satisfy FCC RF energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet (Motorola Publication part number 6881095C99) to ensure compliance with RF energy exposure limits.

FCC Regulation - Letter of Notice

As you know, the iO1500R RF module that we are supplying to you for incorporation into Final Products are components that, when connected to the power supply, internal signaling, and antenna in a Final Product can receive and transmit module signals.

In the United States, the Federal Communications Commission requires that many module transmitting devices obtain approval before being offered on the market, unless the device is exempt. While the iO1500R has been designed to meet applicable FCC requirements, provided in the code of Federal Regulation 47CFR part II subpart J and 47CFR part 90 subpart S, the Final Product's compliance with the FCC's requirements, including RF energy exposure requirements, must reflect product usage, positioning of the iO1500R within the product, the type of antenna used, the location of the antenna, and other factors that may vary with the design and nature of the Final Product. Therefore, compliance with such FCC requirements can only be determined by an assessment of the Final Product.

It is important that any manufacturer to whom you resell the iO1500R for use in a final product also recognize that they will have the responsibility for taking all necessary steps to ensure that the Final Product meets any applicable FCC requirements and for obtaining any necessary approval from the FCC for sale and operation of the Final Product. To the extent that this may require testing and assessment of the Final Product, this will be the responsibility of the manufacturer.

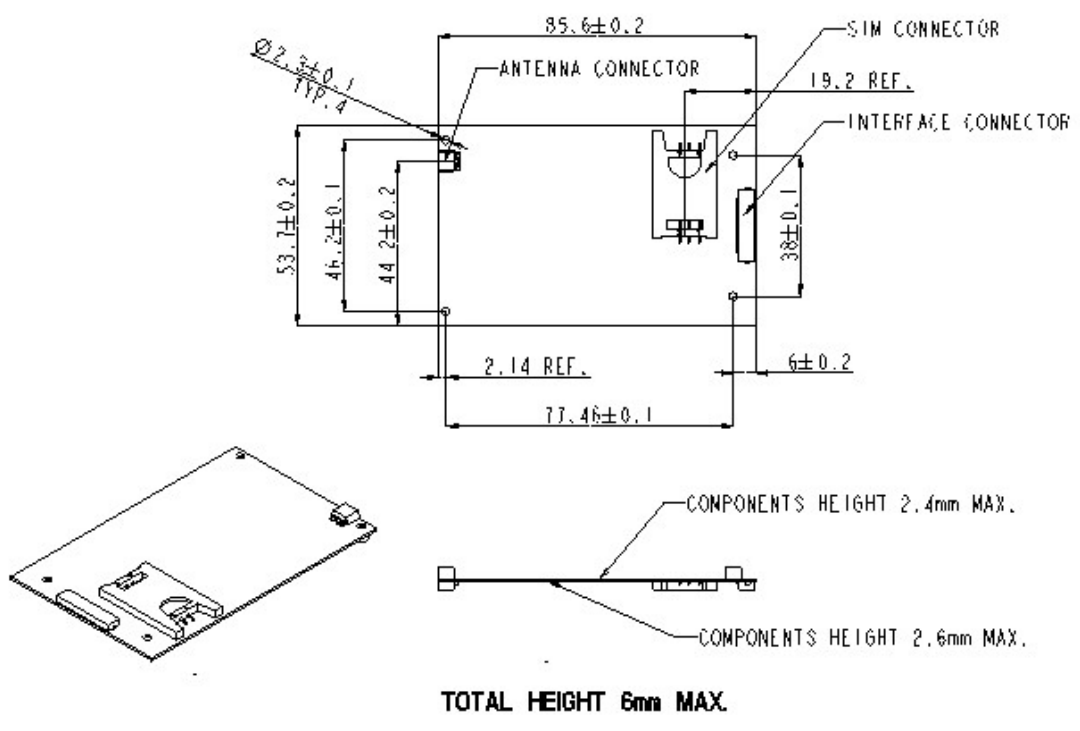
To the extent that this may require development of user information or guidance to be provided to each purchaser of the Final Product, this will also be the responsibility of the manufacturer.

Information covering the FCC tests that are required is located in Appendix A.

Please provide a copy of this reminder to every manufacturer to whom you resell these products.

iO1500R Hardware Interfacing Information

Mechanical Dimensions



Connector Types:

The unit has two connectors:

- RF output connector MMCX Jack (female) 50 Ohm. This will accept the RG 178-11 MMCX-50-1-1 Plug (male) or RG 316-11 MMCX-50-2-3 (male).
- The Data Interface connector is a MOLEX 30-pin ZIF connector,
MOLEX part #: 52892-3090.
Motorola Part #: 0909059E06.

OEM developers must also use this 30-wire flex cable to interface to the connector:

AXON Cable Part#: FFC0.50A30/0035L3-3-06-06SBBB.

Motorola Part #: 3086229J04.

Accessory Connector Pin Functions

PIN #	PIN NAME	DIRECTION	DESCRIPTION	Notes
1	RS232_RX	OUT	RS232 Signal	3V Max
2	RS232_TX	IN	RS232 Signal	3V Max
3	RS232_DTR	IN	RS232 Signal	3V Max
4	RS232_DCD	OUT	RS232 Signal	3V Max
5	RS232_GND	IN	Signal Ground	
6	RS232_RTS	IN	RS232 Signal	3V Max
7	RS232_CTS	OUT	RS232 Signal	3V Max
8	RS232_DSR	OUT	RS232 Signal	3V Max
9	RS232_RI	OUT	RS232 Signal	3V Max
10	EXT_MIC	IN	Audio input to iO1500R	FUTURE USE
11	AUDIO_COMMON	IN	Analog Ground	FUTURE USE
12	AUDIO_OUT	OUT	iO1500R Audio Out	FUTURE USE
13	OPT_SELECT_1	I/O (22K pull-up)	iO1500R configuration	Control Signal
14	OPT_SELECT_2	I/O (22K pull-up)	iO1500R configuration	Control Signal
15	MUX_CNTL	IN (69K pull-down)	Logic "0" (Mfgr.use)	Control Signal
16	OPTION_3V	OUT	Regulated 3.0V Output	
17	OEM ON-OFF	IN (15K pull-down)	Power On/Off	External On/Off 3.6V±5% Max
18	MOD	IN (22K pull-down)	Programming signal	3V Max
19	BAT_VCC	IN	3.6V iO1500R Power	
20	BAT_VCC	IN	3.6V iO1500R Power	
21	BAT_VCC	IN	3.6V iO1500R Power	
22	BAT_VCC	IN	3.6V iO1500R Power	
23	BAT_VCC	IN	3.6V iO1500R Power	
24	RED_LED	OUT	Out-Of-Range indication	3V±2.5%
25	GREEN_LED	OUT	In-Range indication	3V±2.5%
26	BAT_GND	IN	Ground	
27	BAT_GND	IN	Ground	
28	BAT_GND	IN	Ground	
29	BAT_GND	IN	Ground	
30	BAT_GND	IN	Ground	

Detailed Pins Descriptions

RS232 Standard Interface 8-Wire Or 4-Wire (Pin 1 through Pin 9)

This is a 3V DCE RS-232 interface. For $\pm 9V$ use, OPTION_3V (Pin16) can supply power to an external level shifter IC like MAX3238E. The 9-volt external level shifter output can be connected to a PC COM port.

Audio Interface (Pins 10, 11 and 12)

These are future options of the iO1500R to provide audio communication.

Opt_Select_1 and Opt_Select_2 (Pin 13, Pin 14)

The option select lines set the communication state of the module. To support RS232 communication, the option select lines must be connected at one of three modes:

“11” – Default mode via internal 22K pull up resistors.

“01” – Option select 1 is externally pulled to ground.

Diode – Anode to Pin 13 and cathode to Pin 14.

MUX_CNTL (Pin 15)

To use RS232, this pin must be held at logic low (facilitated by internal 69K pull down resistor).

OPTION_3V (Pin 16)

A regulated 3V output from the iO1500R with a maximum drive of 30 mA. This can be used to drive an external RS232 transceiver IC.

Voltage is active only when the OEM is ON.

OEM On-Off (Pin 17)

Used to power up and power down the iO1500R OEM. This is the recommended method for turning the iO1500R on and off and in vehicle applications it can be used as an ignition sense to power up. When this pin is connected to ground, the OEM will turn OFF. When this Pin is connected to BAT_VCC 3.6V, the OEM will turn ON.

MOD (Pin 18)

This pin is internally pulled down via 22K resistor. Motorola recommends routing the MOD signal to an external connector. Should iO1500R software need to be updated, this pin must be available externally, or the flash cannot be programmed, and the iO1500R module will have to be removed from the product to reprogram it. Mod pulled to 3V at power up sets programming mode.

BATT_VCC (Pins 19 through 23)

This is the 3.6 V iO1500R power supply. All should be driven by the same source. Power: 3.6V $\pm 5\%$ max., ripple 50mV. Input current: Avg. 1A, peak 2.5A.

Out-Of-Range indication, RED LED (Pin 24)

This OUTPUT is the Out Of Range Connection Status. It is a switched 3V output voltage with a maximum drive of 10 mA.

Solid Red light - OUT OF RANGE – iO1500R not connected to the iDEN network.

Blinking Red light – iO1500R is registering or connecting to the iDEN network.

In-range indication-GREEN LED (Pin 25)

This OUTPUT is the In-Range Connection Status. It is a switched 3V output voltage with a maximum drive of 10 mA.

Blinking Green light - IN RANGE - the OEM is connected to the iDEN network.

Solid Green light – The iO1500R is in use.

BAT_GND (Pins 26 through 30)

These pins are the ground return lines for the iO1500R and should be connected together with the same ground reference as the 3.6 V power supply for the iO1500R.

Status LED Indications

An on board single LED will be used for multi-purpose status indications as follows:

User Mode	
LED State	Indication
Alternating Red & Green	A fatal error was detected during power-up: - Flashstrap Fatal Error. - Invalid Battery.
Flashing Red	Registering - your PC Card is registering to your carrier's network. Please wait.
Steady Red	No service -your PC Card can't register. It will continue trying to every two minutes as long as it is turned on.
Flashing Yellow	Unit registered - no packet data service.
Flashing Green	In service - your PC Card has successfully completed Packet Data registration.
Steady Green	In use - your PC Card is currently being used

Voice Support

Audio input and output are supported on iO1500R:

- Audio input (from mic) on Zif connector pin 10
- Audio output (to speaker) on Zif connector pin 12
- PTT is supported via option select lines (Zif pins 13 and 14) Pulling both Opt Select lines to ground indicates PTT to radio.

Audio output impedance is 100-ohm. External Audio PA (high input impedance) is required. Nominal output is 64mVrms @ 1KHz.

Audio input impedance is >39K-ohm. The audio source is expected to have output impedance of 100 ohms. Nominal audio input is 43.5mVrms. @ 1KHz

Design Considerations For iO1500R OEM Developers

Hardware Considerations

- Developers need to work with carriers to approve applications on their network.
- The end product must display the IMEI and serial # of the module.
- The module must use OEM_ON-OFF (Pin 17) to power on and off.
- Be aware of current consumption when unit is not registered.
- The external connector on the end product MUST have direct access connections to the iO1500R's PINS, with no relays through other microprocessors or buffers.
- The end product needs FCC approval
- Developers need system test procedures for production processes.
- Developers need to be aware of the requirements of certain pins, mentioned in the pin description section in order to communicate via RS232.
- Care should be taken when interfacing RS232 lines to external interfaces. RS232 pins must not exceed 3.0 volts or the iO1500R will be damaged.
- To use RS232, the MUX_CNTL input (pin 15) must be held at logic low (internal pull down provided).
- The MOD pin is pulled low through an internal 22 KOhm resistor. Motorola recommends routing the MOD signal to an external connector.

Software Considerations

- When integrating the unit inside a terminal, it is required that the user will have access to the module basic service utilities such as: Master Reset, RSSI Display, SQE Display and others. This is accomplished by use of AT commands, as explained later in this document.
- The end product needs to be able to perform a Module Reset and Master Reset commands on the module.
- It is recommended that the unit will be able to display system registration information and RSSI/SQE readings.
- Developers who change default User Image profiles must use proper profile management processes outlined in this document to properly back them up before overwriting them. Packet data services can be lost if this is not handled properly.
- Developers should be able to implement network specific status messages to the end user as an aid for users and for customer care to query the current status the iO1500R.

Module Software And Interface Modes

The iO1500R supports both circuit data over packet data and standard packet data modes. DCE refers to the iDEN iO1500R Module. DTE refers to a computer or data terminal equipment that is connected to the iO1500R Module. Below are the descriptions for each of these data modes.

Circuit Switched Data

The iO1500R Module and the iDEN network interact to provide the DTE with a circuit-switched data interface with the PSTN.

The iDEN infrastructure and data subscribers support circuit data based on TIA/EIA-602 (commonly known as the “Hayes AT Command set” defines messages and procedures that allow a DTE to control the operation of a DCE. The DCE provides dialing, answering, and module services. The messages consists of async ASCII (readable) characters and are sent “in band” between the DTE and DCE (i.e. over the same interface used to transfer the data).

See the iDEN Mobile Subscriber DTE/DCE Interface for Data Services 68P81129E10-C for detailed AT command descriptions. See “How to use Hayes Compatible Packet Data mode” for iDEN data module AT commands.

Packet Data

The iDEN Packet Data service provides wireless datagram-based networking on the iDEN network. Based on the TCP/IP protocol suite, iDEN Packet Data provides a mobile transport layer connecting the mobile node to the Internet.

The conventional method of using iDEN Packet Data (PD) service is via data terminal equipment (DTE) containing a TCP/IP protocol stack.

A DTE connected to an iDEN data module will be able to use IP protocol to transfer data to any IP capable device. For example it will be able to FTP a host computer and browse an Internet site.

Managing User Image Profiles

The iO1500R ships with 3 configurable User Images (Profile 0, Profile 1, and Profile 2)

User Image 0 Profile 0 stores the default factory settings for Circuit Data calls.

User Image 1 Profile 1 is a scratchpad where Profile 0 or Profile 2 is stored by the developer when changing the default settings of Profile 0 or Profile 2.

User Image 2 Profile 2 stores the default factory IP settings for Packet Data or Hayes Compatible Packet Data services.

The iO1500R units ship from factory with the User Image Profile defaulted to Image 2.

Warning When Switching User Image Profiles

Developers should use caution when changing default settings of User Image Profiles in the iO1500R. Before settings of a profile are changed, they should be backed up into the User Image 1 scratchpad for safe keeping, then restored later. If these backups are not performed, then the module will lose setup information and will not be able to use Packet Data services. The recovery from this failure uses several AT commands to restore all the variables one by one. Use this profile management process:

- 1) Set the user default image to the image profile that is to be modified.
- 2) Copy that user image profile into the scratchpad user image profile 1.
- 3) Then change the original image to the new desired settings.
- 4) When the user is finished using the custom settings, copy the original backed up profile from scratchpad user image profile 1 back to the original profile.

Setting The Active User Image

The ATz command sets the active User Image

This loads the specified user image profile from ROM into active RAM.

Usage: ATz<image> (where image can be 0,1 or 2)

User Image 0 Make Circuit Data the active image.

User Image 1 Make the scratchpad the active image.

User Image 2 Load the module with Packet Data parameters.

The iO1500R units ship from the factory defaulted to Image 2.

Example: To select circuit data (Image 0), enter this AT command: **ATz0**

Example: To select packet data (Image 2), enter this AT command: **ATz2**

Properly configuring, saving, and restoring user image profiles

Here is an example of how to properly manage the user image profile AT commands.

Example: The module by default boots up in User Image Profile 2, which is packet data mode. This example will back up Profile 2 into Profile 1 for safe keeping, then change Profile 2 to become Circuit Data, and save these settings permanently into to Module ROM so that the module boots up into Circuit Data mode.

Changing the settings of a user image

- 1) Make User Image 2 the active image: **ATz2**
- 2) View stored parameters to verify: **AT&V**
- 3) Save Profile 2 to Profile 1 for safekeeping: **AT&W1**
- 4) Now make User Image 0 the active image so parameters can be copied: **ATz0**
- 5) Write the Profile 0 parameters to Profile 2: **AT&W2**
- 6) Make User Image 2 the active image to verify the change took place: **ATz2**
- 7) View stored parameters: **AT&V**

The module will now power up in Profile 2, which was customized to be in circuit data mode by the above example. To recover Profile 2, do the following steps:

Restoring the settings of a saved user image

- 1) Make User Image 1 the active image to recover the Image 2 profile data: **ATz1**
- 2) View stored parameters to verify: **AT&V**
- 3) Save Profile 1 to Profile 1 for safekeeping: **AT&W2**
- 4) Make User Image 2 the active image to verify the change took place: **ATz2**
- 5) View stored parameters: **AT&V**

How To Use Hayes Compatible Packet Data mode

Some older legacy DTE equipment that the iO1500R may be interfaced to may not have a TCP/IP stack. These devices use Hayes Module AT commands to communicate. A non-IP interface was implemented inside the module to work with these legacy DTEs using a simulation of Circuit Data Over Packet Data. Terminals that are using AT-Module protocol will be thus be able to communicate with the iDEN data modules and use the iDEN Packet Data services. This capability is only available in the iO1500R and not the standard iDEN modules.

Circuit data over Packet data will operate as follows:

The non-IP DTE will use the AT command set described in the TIA/EIA-602 standard for Circuit Switched Data transmissions, with the following modification:

ATD<IP_address..Port_Number>

instead of :

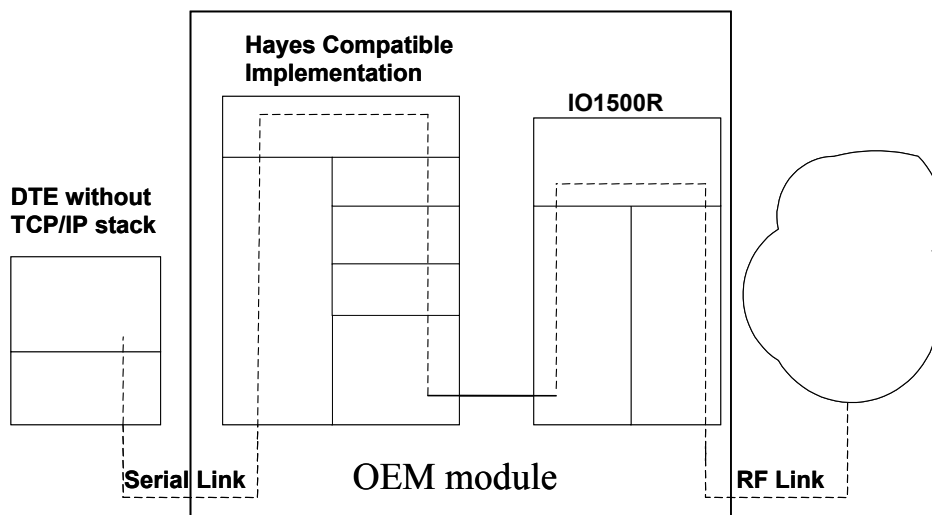
ATD<Phone_Number>

Note: There is no Fax support while in Hayes compatible packet data mode.

An AT command interpreter, implemented in the module software, receives the **ATD<IP_address: Port_Number>** command and transfers it to the Packet Assembler/Disassembler (PAD) which prepare the data in a mobile TCP/IP format which is recognized and transferable by the iDEN infrastructure.

The end result is circuit data interface with packet data over the air.

The user gets circuit data interface for it's dumb terminals with the response time and data rates of packet data.



How To Use Hayes Compatible Packet Data mode (continued)

To send Circuit Data AT commands over the packet data network in the iO1500R iDEN data module, there are 2 methods to setup the configuration:

Method 1: Use the wireless data services for windows applet from the CD supplied with your module to initialize packet data parameters (IP address etc.) in your module and to set the profile for Hayes Compatible Packet Data. The iModule Wireless Data Services user Manual (68P02953C65-A illustrates how to setup the “Hayes Compatible Profile”, by selecting a button in the Module Configuration Menu.

Method 2: Use the **AT+ws45** and **AT+ws46** commands.

AT+ws45 is the Select DTE-Side Stack command, which sets the DTE-side protocol stack to be used by the DCE in on-line data state.

ATws+46 is the WDS-side side (Wireless Data System) stack command, which sets the WDS protocol stack to be used by the DCE for network activities.

Example: Place the DTE side in Hayes compatible packet data mode:

AT+ws45=0

To verify the mode, simply query the module with this command: **AT+ws45?**

The module should respond back with: 0.

Example: To place the WDS side in PPP mode, enter this command:

AT+ws46=24

To verify the mode, simply query the module with this command: **AT+ws46?**

The following table shows the modes and the corresponding parameters for both the **AT+ws45** and **AT+ws46** commands:

Mode	AT+ws45	AT+ws46
iDEN Circuit data/Fax	0	23
Hayes compatible packet data	0	24
Packet data & SLIP	3	24
Packet data & PPP	4	24

WARNING: Use proper profile management procedures mentioned earlier to backup default profiles before changing and writing them to the module.

When verifying that Hayes compatible packet data mode is setup properly, this is the only valid combination: **AT+ws45=0** and **AT+ws46 = 24**

How to use Hayes Compatible Packet Data mode (Continued)

This command will then instruct the DCE (iO1500R module) to originate a call:

ATd <IP_address>.<port#>

Where <IP_Address> = n.n.n.n OR n,n,n,n where 1<n<255, and

<port#> is optional ..p or ,,p 1<=p<= 65535

<IP_address> and <port#> MUST be separated by two dots”..” or two commas “,,”, but no matter which character is used, there must be 2 of them.

Example: ATd 128.54.88.104..80

will tell the iO1500R to connect to the IP address shown above, and through port #80.

The DCE will respond with: ”Connect <baud rate>”, which means the module is connected at the baud rate displayed.

- 1. Continue to work. Transmit and receive data from the other side.**
- 2. To disconnect the call and get back to command mode type +++.**
- 3. The module will respond with “OK”. Then type ATH to hang up.**

Other Useful AT Commands

View stored parameters with the AT&V command

To verify that the right image is used enter this command: **AT&V**

The iO1500R will display several lines of information regarding the current setup of the module. The very first line of information will display “Active User Image”. If the iO1500R is in packet data mode, the display will read “Active User Image: 2”. The AT&V query command also displays the current status of the AT+ws45 and AT+ws46, a sanity check to determine if the module is setup in Hayes Compatible Packet Data mode, or any other mode.

How to configure the baud rate with the AT+IPR command

Configure the iDEN data module for the baud rate of your DTE. The default baud rate of the module is auto baud. Do not leave as auto baud. To configure the baud rate of the iDEN data module, use this command:

AT+IPR=baud rate

Example: AT+IPR=19200 will set the baud rate to 19200.

The status of the current baud rate setting can then be shown with the baud rate query:
AT+IPR?

The iO1500R will respond back with: **+IPR: 19200**

Reset, Master Reset, Power off

The requirements of setting these functions may vary by service provider. The service provider may ask the developer to perform these functions, which are accomplished through a keypad on a normal phone. But on the iO1500R, these functions can be accomplished using the Applet program from the CD, or by using AT commands that can be sent to the iO1500R:

AT Command To RESET the iO1500R.

This message tells the module to perform a full reset as if the module cycled power:

AT+wwreset

AT Command For Master Reset

The carrier may ask the developer to Master Reset the iO1500R when certain changes are made, or the developer will need to Master Reset the iO1500R after new software is flashed into the module. This is not the same as RESET, and should only be run in the above scenarios. This is the AT command to be used:

AT+wwmr="xxxx"

Where "xxxx" is the correct pass code. Typically on new units, the default pass code is 0000. In most cases to perform a master reset, enter the AT command like this:

AT+wwmr"0000" (no space between any characters)

AT Command To Power the iO15 off.

This message tells the modem to perform a safe software power off:

At+wwpo

SIM AT commands,

As for Condor based product, the iO15 modem has a SIM card. The management of the SIM cards can be done using the following AT commands:

AT Command To Unlock the iO15 SIM card.

At+wwsim

The SIM PIN should be between 4-8 digits Operator.

Operator	Syntax
Execute	+wwsim="<SIM PIN>"
Query	+wwsim?
Range	+wwsim=?

Response:

- "NO LOCK" - in case the SIM is not locked.

- "SIM LOCK" - in case SIM is locked. PIN must be entered in order to unlock the SIM.
- "PIN BLOCK" - in case the PIN is blocked due to three consecutive unsuccessful attempts to unlock the SIM. Need to use the Configuration Applet program and PUK code delivered by the SIM card provider in order to unblock, or get service.
- "PUK BLOCK" - in case PUK is blocked due to ten consecutive unsuccessful attempts to unblock the SIM PIN. The SIM has become unusable.
- "LOCK NO SIM" - There is no SIM in the radio. Need to insert SIM.
- "LOCK SIM MEM ERR" - Memory error in the SIM. Need to get service.
- "LOCK SIM TECH ERR" - Technical error in SIM. Need to get service.
- "ERROR" - All other cases.

AT Command To enable or disable the SIM PIN lock mechanism.

At+wvsimtgl

The SIM PIN should be between 4-8 digits. The first parameter indicates whether to enable or disable the lock mechanism.

Operator	Syntax
Execute	+wvsimtgl= <i>n</i> ,"<SIM PIN"> with <i>n</i> =0 for enable and <i>n</i> =1 for disable
Query	+wvsimtgl?
Range	+wvsimtgl=?

Response:

- ENABLED
- DISABLED
- ERROR

Other useful iO15 AT commands

Service Status Log (SSL) AT command

To assist "customer care" in troubleshooting many of their most frequently experienced "registration" and activation issues, the MS captures the results of DAP registration, Location Updates, PD Registrations and MIP Registrations in a log that can be displayed via the "diagnostic mode" menu. Also, results for Phone Restricted can be displayed for SIM capable phones. The result of the most recent transaction (per procedure) is saved. Any subsequent transactions will overwrite the result previously stored. These results are only stored in volatile memory and therefore are not stored across power ups. In Addition the log shows the current IN or OUT of service state for DAP, LU, PD and MIP.

SSL command syntax

At+wptrace

SSL Command response

The SSL AT command response will have the following syntax:

DISPATCH [IS,NS (2 bytes)] [ACPT, RJCT, N_AT (4 bytes)] [RNC (6 bytes)] [0-4 cause codes, 2 bytes each, separated by comma]
INTERCONNECT [IS,NS (2 bytes)] [ACPT, RJCT, N_AT (4 bytes)] [RNC (6 bytes)] [0-4 cause codes, 2 bytes each, separated by comma]
PACKET DATA [IS,NS (2 bytes)] [ACPT, RJCT, N_AT (4 bytes)][RNC (6 bytes)] [0-4 cause codes, 2 bytes each, separated by comma]
MOBILE IP [IS,NS (2 bytes)] [ACPT, RJCT, N_AT (4 bytes)][RNC (6 bytes)] [0-4 cause codes, 2 bytes each, separated by comma]
PHONE RST [IS,NS (2 bytes)] [RSTR, N_AT (4 bytes)] [RNC 6 bytes] [0-4 cause codes, 2 bytes each, separated by comma]

Each SSL entry is presented in one line.

The [] signs indicate a field with possible values and length.

PC Applications To Control the iO1500R

FVN4780A - iDEN module - Packet Data Applet

This program can be used with the iO1500R sitting on the Evaluation Board. See the iM1000 Data Module User's Guide - 68P02953C65-A for detailed description about how to install and use this program. The complete application is composed of three software modules: Status Program, Configuration Program and Service Program.

Status Program

The Status Program window is a Windows only program that is part of the module applet, and provides an enhanced method of starting a PPP or SLIP connection to the module. It also provides some helpful information about the DCE (iO1500R OEM Module) and Packet Data communication. For example the program can display RSSI, Kbytes sent/received and more.

Configuration Program

The Configuration Program provides a method for configuring and displaying networking parameters (Primary and secondary DNS, Server IP address, etc.) and modem parameters for packet data services. It provides a method for customizing user settings (for example: Master Reset, SIM PIN change/unblock/enable/disable, etc.) and allows the user to define the default data service.

Service Program

The Service Program is a GUI that provides service technicians a method to perform field-testing for an iO15 modem.

iDEN data modules – Software integration.

The iDEN data module system integrator has a choice of software tools to help in the development of applications for the iO1500R OEM Module:

1. AT command set as described in iDEN Mobile Subscriber DTE/DCE Interface for Data Services.
2. For integrators with non-PC operating system, Motorola provides two types of RALP (Module Application Layer Protocol) command support: Full RALP and SDK RALP. The SDK functions were developed over this protocol.

There is an NDA and a fee required to get the RALP document.

Visit the iDEN developer site at <http://www.idendev.com/> for an overview, download documentation, get sample code and other data application development tools.

Listed below are recommendations of the software interfacing procedure for the iDEN data modules with external devices and the iDEN infrastructure.

1) Configure the iDEN data module for the baud rate of your DTE. The default baud rate of the module is auto baud. Do not leave as auto baud.

AT	Check communication with the module.
AT+IPR=baud rate	Configure the baud rate of the iDEN data module.

2) Configure the iO1500R module for a PPP/SLIP connection.

AT	Check communication with the module first.
ATZ2	Sets Profile 2 with.AT+WS46=24
AT+WS45=4	Sets the DTE protocol stack to Packet Data PPP/SLIP
ATE0	Set ECHO Off
AT&W2	Store configuration to module's Profile 2. (Storing new Configuration will overwrite the default configuration.)

3) Check module network status.

PPP Connection should not be established until MIP Registration is complete.
Network status can be checked using AT commands.

Check Signal Quality with this AT command: **AT+WS53?**

Range: 0-100 (Minimum working levels for Signal Quality are between 75-80).

Check mobile IP registration with this AT command: **AT+WPSTATE**

(Return data has a few lines; the last line contains the Mobile IP registration status)

See the iDEN Mobile Subscriber DTE/DCE Interface for Data Services 68P81129E10-C for detailed AT command descriptions.

If SQE value read in using the AT53 command is OK and the iDEN data module is Mobile IP registered go to step 4).

If Signal Quality is not good, wait in the loop, checking signal quality every 10 sec, until a usable value is measured.

If the iDEN data module is not Mobile IP registered wait for 1 minute, checking MIP registration status every 10 seconds. If after one minute the iDEN data module is not MIP registered, a new registration needs to be forced. Use AT-commands to force the module de-registration and re-registration:

Force deregistration **AT+WPDEREG**
Force registration **AT+WPREG**

Go back to Step 3) again.

4) Wait for at least 2 seconds and make the PPP/SLIP connection

ATZ2 Go to profile 2.
ATD Start PPP/SLIP connection, according to the AT+WS45 setup.

5) During the PPP/SLIP connection check network status periodically.

Check Signal Quality with this AT command: **AT+WS53?**

If Signal Quality is not good, wait in the loop, checking signal quality every 10 sec, until a usable value is measured.

If iDEN data module is not Mobile IP registered wait for 1 minute, checking MIP registration status every 10 seconds. If after one minute the iDEN data module is not MIP registered, a new registration needs to be forced. Drop PPP/SLIP connection. Use AT-commands to force iDEN data module de-register and re-register again.

Force deregistration **AT+WPDEREG**
Force registration **AT+WPREG**
Go back to Step 3)

Additional Information For Registering and Going Offline

Module Activation and Registration

When you buy the module from iDEN operators your module must be registered in the system database. Upon power up, the module is registered and a set of data parameters is downloaded *over the air* into the unit. In case the module is not registered, you will need to give to the system administrator the unit IMEI number for registration (some operators may also need the serial number of the unit). These numbers can be found on the unit label together with the model number, the FCC ID number and the Canadian safety ID number.

AT-commands:

Each AT command sent is expecting its own response as an echo, or an OK.

To make the iO1500R module re-register perform these steps:

1. Send the **AT+WPDEREG** command to un-register the module.
2. Wait three second for the iO1500R module response.
3. Send the **AT+WPREG** command to register the module.
4. Wait 5 seconds. **Do not check module response while waiting.**
5. Poll registration status using the **AT+WPREGSTATE** command.
6. Wait for 2 seconds for the reply from the iO1500R.
7. Loop: If the DTE did not receive a response go back to Step 5.
8. If the “REGISTERED” response is received, proceed to the next stage.

Monitoring The RS232 CD pin and Going Offline:

While online, the DTE should monitor the CD signal on the iO1500R to see if it went inactive. If the iO1500R did go inactive, DTE should do the following:

- 1) Tear down the PPP/SLIP connection.
- 2) Disconnect the module using +++ string, wait one second.
- 3) Send an **AT** command. The module should respond with an OK. If the DTE is not getting an OK it should continue sending +++ to disconnect the module.
- 4) Wait one second and send the **AT** command until an “OK” is received.

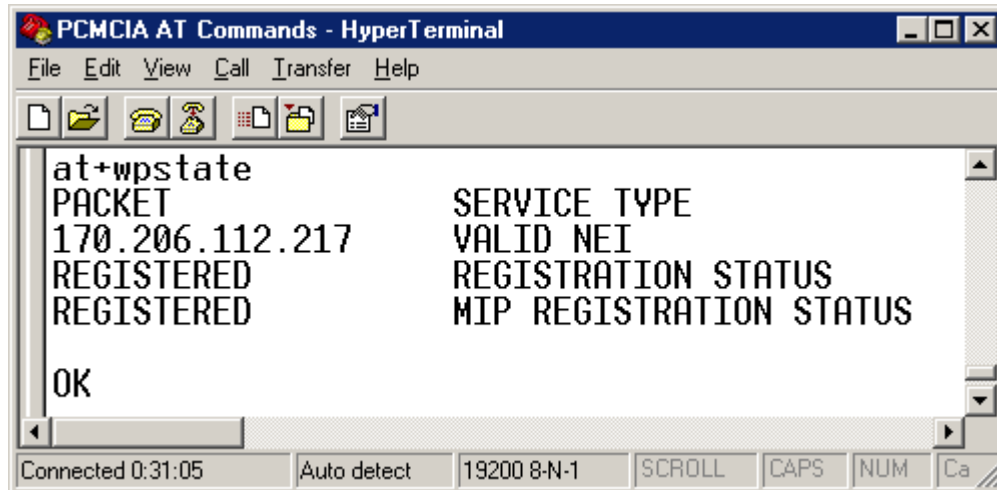
If the timeout elapsed with no module response or during wait time another message has been received (e.g. NO CARRIER) start to reconfigure the module all over again.

Packet Data Status Information Command

To check the current state of the iO1500R, use the Packet Data Status Information command. This is the AT command to be used:

AT+wpstate

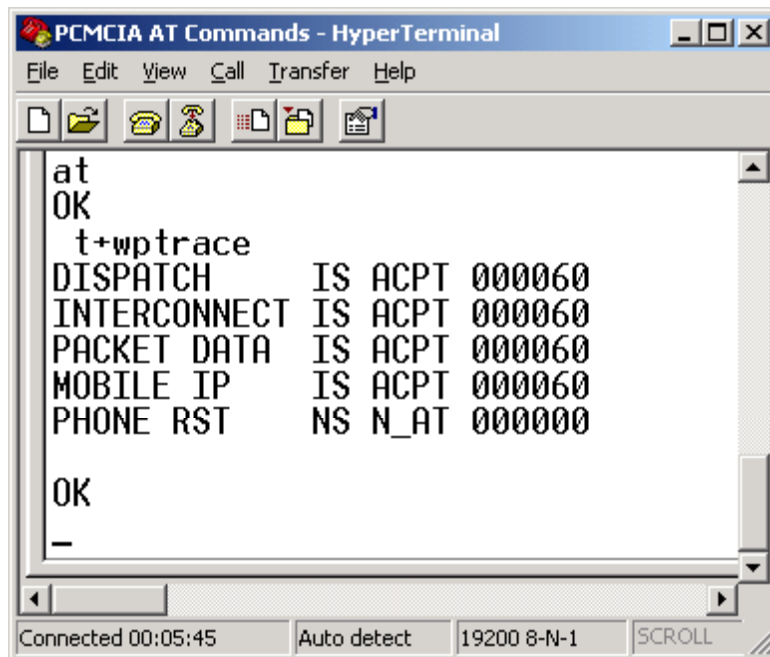
Below is what the iO1500R might respond with when this command is used:



```
PCMCIA AT Commands - HyperTerminal
File Edit View Call Transfer Help
[at+wpstate
PACKET 170.206.112.217 SERVICE TYPE
REGISTERED VALID NEI
REGISTERED REGISTRATION STATUS
MIP REGISTRATION STATUS
OK
Connected 0:31:05 Auto detect 19200 8-N-1 SCROLL CAPS NUM Ca
```

AT+wptrace

Below is what the iO1500R might respond with when this command is used:



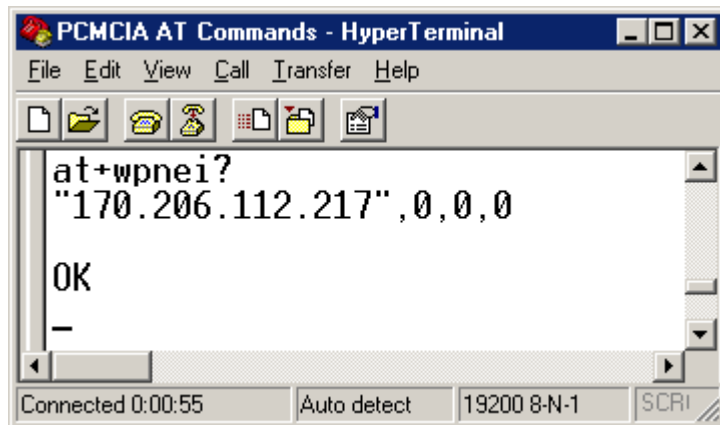
```
PCMCIA AT Commands - HyperTerminal
File Edit View Call Transfer Help
[at
OK
t+wptrace
DISPATCH IS ACPT 000060
INTERCONNECT IS ACPT 000060
PACKET DATA IS ACPT 000060
MOBILE IP IS ACPT 000060
PHONE RST NS N_AT 000000
OK
_
Connected 00:05:45 Auto detect 19200 8-N-1 SCROLL
```

IP Address/ Network Entity Identifier (NEI) Command

To check the current IP address of the iO1500R node, as well as the Network Entity Identifier (NEI), use the DTE IP Address query command as follows:

AT+wpnei?

Below is what the iO1500R might respond with when this command is used:



```
at+wpnei?  
"170.206.112.217",0,0,0  
OK  
-
```

First the IP address is displayed in quotes, followed by the current NEI.

Summary Of AT Commands

This is a consolidated list of the AT commands mentioned in this document.

See the iDEN Mobile Subscriber DTE/DCE Interface for Data Services 68P81129E10-C for detailed AT command descriptions.

General AT Commands

Command	Usage	Remarks
AT	AT	Checks communication.
ATE _x	ATE0 or ATE1	Sets echo on or off.
AT&V	AT&V	Displays module parameters.
AT+IPR	AT+IPR= baud rate	Sets the baud rate of the module

User Image Profile Management Commands

Command	Usage	Remarks
ATz	ATz0, ATz1, or ATz2	Sets the specified image as the active image.
AT&W _x	AT&W0, 1, or 2.	Writes active image to the specified profile.

Hayes Compatible Packet Data Commands

Command	Usage	Remarks
AT+ws45	AT+ws45=0 or 3 or 4	Selects the DTE side protocol stack.
AT+ws46	AT+ws45=23 or 24	Selects the carrier/network side stack.
ATd	ATd <IP_address>.. _{<port#>}	Tells module to originate a call.

Registration, Reset, and power off Commands

Command	Usage	Remarks
AT+wwreset	AT+wwreset	Resets the iO15 modem.
AT+wwmr	AT+wwmr="xxxx" (0000)	Master Resets the iO15 modem.
AT+wwpo	At+wwpo	Software Powers Off the iO15 modem.
AT+WPDEREG	AT+WPDEREG	Forces modem to deregister.
AT+WPREG	AT+WPREG	Forces modem to register
AT+trace	AT+trace	Service Status Log

SIM card management Commands

Command	Usage	Remarks
AT+wwsim	+wwsim="<SIM PIN>"	Unlocks the SIM card.
AT+wwsim	+wwsim?	Query SIM status.
AT+wwsim	+wwsim=?	Range.
AT+wwsimctl	+wwsimctl=1,"<SIM PIN>"	Enables SIM PIN mechanism
AT+wwsimctl	+wwsimctl=0,"<SIM PIN>"	Disables SIM PIN mechanism
AT+wwsimctl	+wwsimctl?	Query SIM PIN mechanism status.
AT+wwsimctl	+wwsimctl=?	Range.

Network Status Commands

Command	Usage	Remarks
AT+WS53?	AT+WS53?	Check Signal Quality.
AT+WS50?	AT+WS53?	Check Signal Strength.
AT+WPSTATE	AT+WPSTATE	Check mobile IP registration.
AT+WPNEI?	AT+WPNEI?	DTE IP Address

Appendix A: Requirements For FCC Testing

The iO1500R has a built in testing software mode called “BERBUG” that is preferable for FCC testing. This mode, which will be activated by Motorola, allows the engineers to perform FCC tests.

In BERBUG mode, the developers can communicate with the iO1500R using Windows HyperTerm program, and prewritten scripts provided by Motorola. These scripts are simple text files (.TXT format), which are sent to the iO1500R module via a PC COM port using Hypeterm. The engineers performing the tests for FCC should use these scripts then RESET the module after each test. The developer should make sure the iO1500R OEM Module is connected to a serial com port on a PC.

It is recommended that development engineers who will be taking data for FCC approval use the Motorola iO1500R FCC filing as a guide. This filing can be viewed online at the FCC’s web site. These instructions show how to access the filing:

Preferred method of accessing the iO1500R FCC filing

If you are viewing this guide online, simply click on this link below to access the iO1500R FCC filing:

http://gullfoss2.fcc.gov/cgi-bin/ws.exe/prod/oet/forms/reports/Search_Form.hts?mode=Edit&form=Exhibits&application_id=92993&fcc_id=AZ492FT5826

Alternate method of accessing the iO1500R FCC filing

If you cannot access the iO1500R FCC filing using the above method, try this manual method that will also take you to the filing.

- 1) On the Internet, browse to the FCC search site: www.fcc.gov/oet/fccid/
- 2) Two pieces of information are needed here to locate the filing. In the field marked “Grantee Code”, enter this value: **AZ4**.
- 3) In the field marked Equipment Product Code, enter this value: **92FT5826**.
- 4) Hit the “Start Search” button. The results page shows a table listing the different versions of the filing that were submitted.
- 5) In the query results, click the icon under “Display Exhibits”. This brings up a list of all the exhibits (documentation, test results, charts, graphs, test methodology, etc.) that were submitted for this filing, in PDF format.

Which files to use

The files that are the most useful are the Test Reports and also the Test Setup files. Specifically, look for Measured Data A, Measured Data B, Measured Data C, and Test Setup Photos, which also contain test procedures.

The following tests should be performed on the iO1500R by qualified personnel to submit for FCC type approval of the product that will contain the iO1500R:

- **Conducted Emissions and Radiated Emissions Transmit Mode**
The iO1500R is cabled to a spectrum analyzer, looking for spurious emissions. Data should be taken at 3 TX frequencies: low, mid and high, with the iO1500R set to continuous transmit. Data should be taken from the 10th harmonic, down to lowest fundamental frequency in the unit. The low, mid, and high frequencies used are: 806.0625 MHz, 813.5625 MHz, and 824.9875 MHz. Script files are provided to automate the FCC tests using Hyperterm to set the iO1500R to the proper transmit mode. See the following pages for directions.
- **Conducted Antenna Output Jack Receive Mode** – Typically used for Canada filings. A spectrum analyzer is cabled to the iO1500R. Look on the spectrum analyzer for spurious power out of receive band. Data should be taken at 2 frequencies, low and high, and the iO1500R set to continuous receive. Script files are provided to automate the FCC tests using Hyperterm to set the iO1500R to the proper receive mode. See the following pages for directions.

Receiver Spurious Radiation – The iO1500R should not be registered to a cell tower during the test. Ensure that the iO1500R module is in continuous searching mode, with no timeout set. A dummy load should be used to ensure that the iO1500R does not find any carrier. Canada requires this data to be taken, the U.S. does not. Data should be taken up to the third harmonic, at three frequencies. Script files are provided to automate the FCC tests using Hyperterm to set the iO1500R to the proper receive mode. See the following pages for directions.
- **Occupied Bandwidth Pursuant to 47 CFR 2.989** - Tested at 3 different data transmit modes, measured both at high and low power output. Script files are provided to automate the FCC tests using Hyperterm to set the iO1500R to the proper transmit mode for occupied bandwidth. See the following pages for directions.
- **ERP- Effective Radiated Power, CW test method.**

Instructions for these modes appear on the following pages. These FCC files will be emailed on an as needed basis to developers who purchase the special FCC version of the iO1500R with the FCC testing software installed. These FCC script files can be downloaded directly from the iDEN Developer Program web site at <http://www.motorola.com/idendev/>. The developer should load all the FCC script files into a folder on the PC to be used with testing.

Conducted Emissions & Radiated Emissions Transmit Mode Tests

Step 1: Copy the Hyperterm file called “iO1500R FCC Testing.HT” to the Windows desktop. This file must be used to open Hyperterm, as it automatically sets up several parameters like baud rate and com port to allow Hyperterm to correctly talk to the iO1500R. Double clicking this icon opens Hyperterm to use COM1. Also, copy all the FCC script files into a folder on the PC.

For Radiated Transmit tests, use a 50 ohm RF dummy load.

For Conducted Transmit tests, just connect a cable to the antenna port.

Step 2: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer. Since the iO1500R with FCC software will communicate with the PC using RS232, the RS232 lines on the iO1500R should be made available to the external housing of the developer’s product by way of a connector.

Step 3: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

BERBUG>

Step 4: The module is now ready to be placed in Transmit mode. This will be accomplished by browsing to the folder where the FCC script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

Transfer > Send Text File > FCC_TX_806.0625.txt

This file is used for Conducted or Radiated Transmit Testing at 806.0625 MHz.

Step 5: As the script is sent to the iO1500R, Hyperterm lists the commands sent:

```
BERBUG> tx freq 806.0625  
BERBUG> tx pseudo  
BERBUG> train 200  
BERBUG> mode tx  
BERBUG>
```

Step 6: The transmitter is now on. When testing is completed, the transmitter of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 7: Repeat Steps 4 - 6 with the other 2 files for Conducted Transmit Testing:

FCC_TX_813.5625.txt and **FCC_TX_824.9875.txt**.

Conducted Antenna Output Jack Receive Mode

Step 1: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer.

Step 2: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

```
BERBUG>
```

Step 3: The module is now ready to be placed in Receive mode. This will be accomplished by browsing to the folder where the FCC RX script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

```
Transfer > Send Text File > FCC_RX_851.0125.txt
```

This file is used for Conducted or Radiated Receive Testing 851.0125 MHz.

Step 4: The script commands are sent to the iO1500R and the Hyperterm screen will display the following information:

```
BERBUG> rx freq 851.0125  
BERBUG> rx static  
BERBUG> mode rx  
BERBUG>  
DSP has lost sync!
```

The module will respond with “DSP has lost SYNC!” since there is no signal for the module to receive. This is normal and hitting the “Enter” or “Return” key will return the “BERBUG>” prompt and the iO1500R will be in constant receive mode.

Step 6: When testing is completed, the receiver of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 6: Repeat Steps 3 - 5 with the other 2 files for Conducted Receive Testing: **FCC_RX_858.5625.txt** and **FCC_RX_869.9875.txt**.

Receiver Spurious Radiation Pursuant to 47 CFR 15.109 (a), (f)

Step 1: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer.

Step 2: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

```
BERBUG>
```

Step 3: The module is now ready to be placed in Receive mode. This will be accomplished by browsing to the folder where the FCC RX script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

```
Transfer > Send Text File > FCC_RX_851.0125.txt
```

This file is used for Conducted or Radiated Receive Testing 851.0125 MHz.

Step 4: The script commands are sent to the iO1500R and the Hyperterm screen will display the following information:

```
BERBUG> rx freq 851.0125
BERBUG> rx static
BERBUG> mode rx
BERBUG>
DSP has lost sync!
```

The module will respond with “DSP has lost SYNC!” since there is no signal for the module to receive. This is normal and hitting the ”Enter” or “Return” key will return the “BERBUG>” prompt and the iO1500R will be in constant receive mode.

Step 6: When testing is completed, the receiver of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 6: Repeat Steps 3 - 5 with the other 2 files for Conducted Receive Testing: **FCC_RX_858.5625.txt** and **FCC_RX_869.9875.txt**.

Occupied Bandwidth Pursuant to 47 CFR 2.989

Occupied bandwidth must be tested at 3 different data transmit modes, measured both at high and low power output. The transmit modes are 16QAM, 64 QAM, and QPSK, which is also known as 4 QAM.

Steps for High Power 16 QAM Transmit mode

Step 1: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer.

Step 2: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

```
BERBUG>
```

Step 3: The module is now ready to be placed in 16 QAM Transmit mode. This will be accomplished by browsing to the folder where the FCC RX script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

```
Transfer > Send Text File > Occupied_BW_16QAM_High_Power.txt
```

Step 4: As the script is sent to the iO1500R, Hyperterm lists the commands sent:

```
BERBUG> tx freq 824.9875  
BERBUG> tx pseudo  
BERBUG> train 200  
BERBUG> mode tx  
BERBUG>
```

Step 5: The transmitter is now on in 16 QAM, with data scrolling up the screen. When testing is completed, the transmitter of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle The data is still scrolling by, but just keep typing and it will work. The data will still scroll until the next reset command.
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 6: Repeat Steps 3 - 5 with the file for Low Power 16 QAM Occupied Bandwidth: **Occupied_BW_16QAM_Low_Power.txt**

Occupied Bandwidth (continued)

Steps for High Power 64 QAM Transmit mode

Step 1: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer.

Step 2: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

```
BERBUG>
```

Step 3: The module is now ready to be placed in 64 QAM Transmit mode. This will be accomplished by browsing to the folder where the FCC RX script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

```
Transfer > Send Text File > Occupied_BW_64_QAM_High_Power.txt
```

Step 4: As the script is sent to the iO1500R, Hyperterm lists the commands sent:

```
BERBUG> tx freq 824.9875  
BERBUG> tx pseudo  
BERBUG> train 200  
BERBUG> qam 64  
BERBUG> frame pda  
BERBUG> dcap len 0  
BERBUG> dcap bandm db6db6  
BERBUG> mode tx
```

Step 5: The transmitter is now on in QAM 64 mode, with data scrolling up the screen. When testing is completed, the transmitter of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle The data is still scrolling by, but just keep typing and it will work. The data will still scroll until the next reset command.
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 6: Repeat Steps 3 - 5 with the file for Low Power 64 QAM Occupied Bandwidth:

```
Occupied_BW_64_QAM_Low_Power.txt
```

Occupied Bandwidth (continued)

Steps for High Power CPSK (4 QAM) Transmit mode

Step 1: Connect the product containing the iO1500R with FCC testing code to the COM1 port of the computer.

Step 2: Power up the iO1500R. The Hyperterm window should show the software initializing on the module with a copyright statement, version information, then should present the user with a prompt that looks like this:

```
BERBUG>
```

Step 3: The module is now ready to be placed in CPSK Transmit mode. This will be accomplished by browsing to the folder where the FCC RX script files were placed, choosing the proper script file, and sending it to the module. In Hyperterm, on the top menu line, choose:

```
Transfer > Send Text File > Occupied_BW_QPSK_High_Power.txt
```

Step 4: As the script is sent to the iO1500R, Hyperterm lists the commands sent:

```
BERBUG> tx freq 824.9875  
BERBUG> tx pseudo  
BERBUG> train 200  
BERBUG> qam 4  
BERBUG> frame pda  
BERBUG> dcap len 0  
BERBUG> dcap bandm db6db6  
BERBUG> mode tx
```

Step 5: The transmitter is now on in QPSK mode, with data scrolling up the screen. When testing is completed, the transmitter of the iO1500R module should be turned off with the following command in Hyperterm:

```
BERBUG> mode idle   The data is still scrolling by, but just keep typing and it will work. The data will still scroll until the next reset command.
```

To prepare for the next data point, the iO1500R module should be reset or power cycled to start with a clean slate. Use this command to reset the iO1500R module:

```
BERBUG> reset
```

Step 6: Repeat Steps 3 - 5 with the file for Low Power QPSK Occupied Bandwidth: **Occupied_BW_QPSK_Low_Power.txt**