

# Tutorial for Open AT® V3.04

Revision: 002
Date: May 2006

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# Tutorial for Open AT® V3.04

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# Overview

This tutorial describes the process to develop an Open AT® application using the Open AT® Project Wizard & Visual C++ Development environments, and how to download & start the Open AT® application on a Wavecom product.


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# 1 Introduction

## 1.1 References

| | |
|---|---|
| [DocRef1] | Open AT® Basic Development Guide (ref WM_DEV_OAT_UGD_00052 Revision 2) |
| [DocRef2] | Tools Manual (ref WM_DEV_OAT_UGD_00051 revision 2) |
| [DocRef3] | AT Command Interface Guide (ref WM_DEV_OAT_UGD_00016 revision 8) |

## 1.2 Glossary

| | |
|---|---|
| **AT commands** | Set of standard modem commands. |
| **AT function** | Software that processes AT commands and AT subscriptions. |
| **Embedded application** | User application sources to be compiled and run on a Wavecom product. |
| **Embedded OS** | Software that includes the Embedded application and the Wavecom library. |
| **Target** | Open AT® compatible product supporting an Embedded Application. |
| **Target Monitoring Tool** | Set of utilities used to monitor a Wavecom product. |
| **Receive command pre–parsing** | Process that intercepts AT responses. |
| **Remote Application** | Set of libraries enabling the User to run his application on a PC. |
| **Send command pre–parsing** | Process that intercepts AT commands. |
| **Wavecom library** | Library delivered by Wavecom to interface Embedded application sources with Wavecom OS functions. |
| **Wavecom OS** | Set of GSM and open functions supplied to the User. |


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## 1.3 Abbreviations

| | |
|---|---|
| API | Application Programming Interface |
| CPU | Central Processing Unit |
| IDE | Integrated Development Environment |
| IR | Infrared |
| KB | Kilobyte |
| OS | Operating System |
| PDU | Protocol Data Unit |
| RAM | Random-Access Memory |
| ROM | Read-Only Memory |
| RTK | Real-Time Kernel |
| SMA | SMall Adapter |
| SMS | Short Message Services |
| SDK | Software Development Kit |


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# 2 Create Applications with the Open AT® Project Wizard

## 2.1 Creating an application with the Open AT® Project Wizard

This Wizard provides a user-friendly way to create an Open AT® project. The different steps to create an Open AT® project are listed in the following paragraphs.

### 2.1.1 Step 1 : Launching the Open AT® Project Wizard

The Open AT® Project Wizard may be launched from the **"Start->Wavecom->Open AT->Open AT Project Wizard"** shortcut.

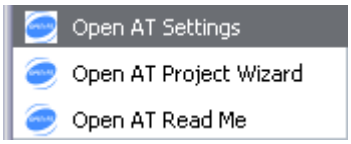



Figure 1: Open AT® Project Wizard shortcut in the Start menu


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The Open AT® Project Wizard window is then displayed.

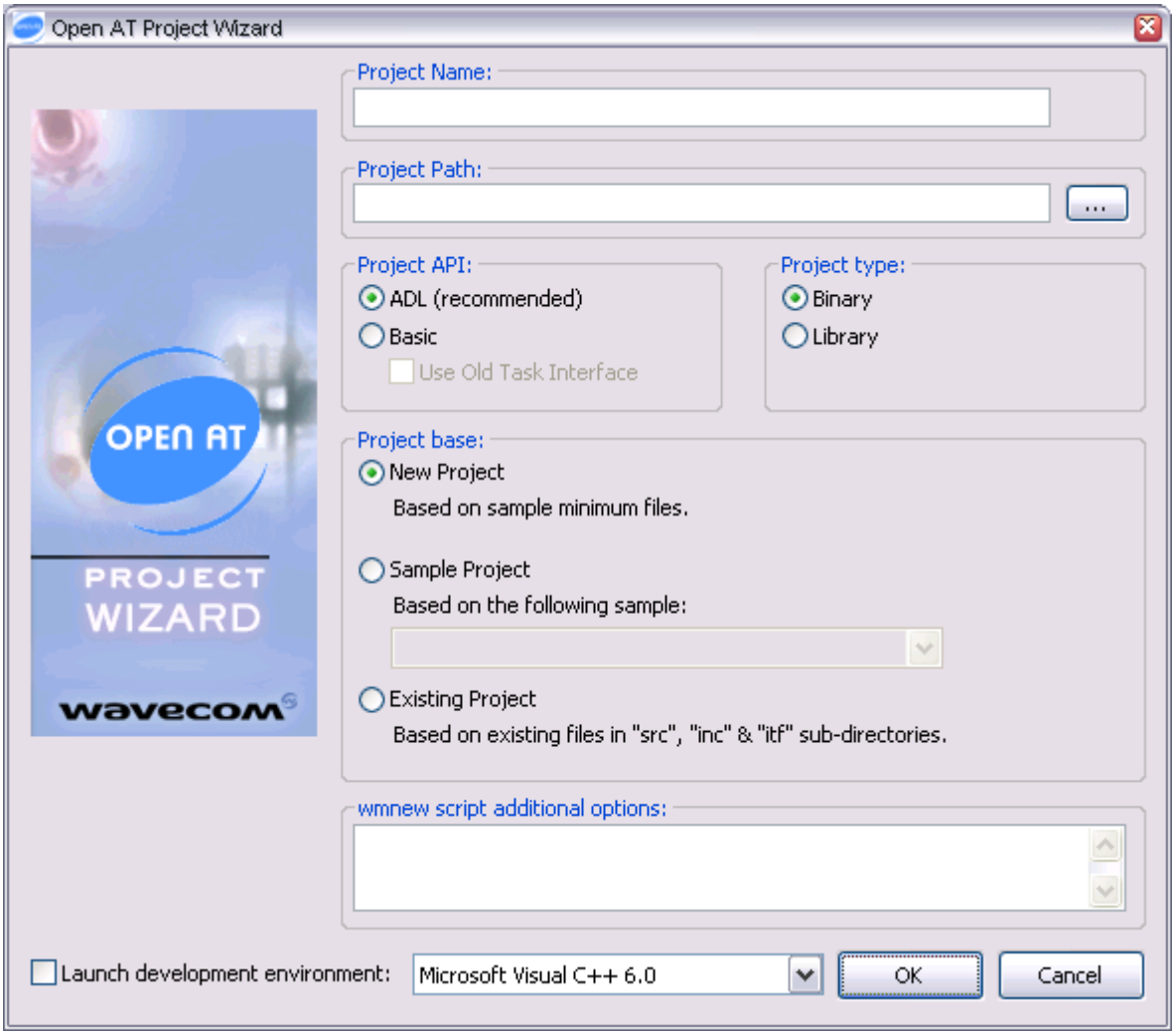



Figure 2: Open AT® Project Wizard

### 2.1.2 Step 2 : Project location

Then, the project location has to be set. The corresponding text field may be updated to set this parameter. The  button may be used to access to an existing directory. New directory may be added manually in the text field (new directories will be automatically created by the setup).


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Please note that the selected directory will be the real project root directory, so it should not contains any file before creating the new project.

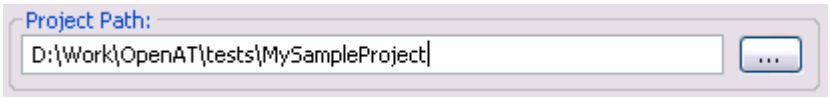



Figure 3: Project path

### 2.1.3 Step 3 : Project API

We can now choose the project API. The ADL API is strongly recommended, since the Basic API is reserved for advanced users, and was kept for ascendant compatibility with older versions.

**For this sample, the ADL interface will be kept.**

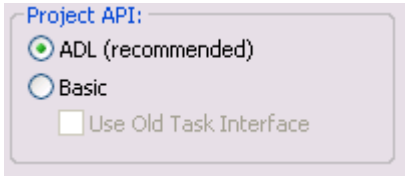



Figure 4 : Project API

### 2.1.4 Step 4 : Project Type

Here we define if the generated project will be an Open AT® library or binary. Open AT® libraries are just C standard libraries, using the Open AT interfaces. Open AT® binaries are the Open AT® applications themselves.

**For this sample, the Binary type will be kept.**

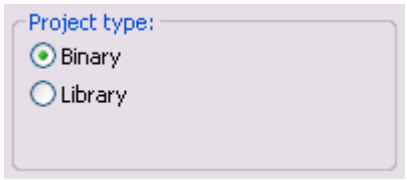



Figure 5 : Project type


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### 2.1.5 Step 5 : Project Base

Open AT® projects are created from New Project or Samples Project bases, and may be updated using the Existing Project option.

- **New Project:** The Wizard will insert template source files into the project with the basic functions (see the minimum embedded application code in the Development Guides).
- **Sample Project:** The Wizard will create a new project, with a copy of a sample provided on the Open AT® CD-ROM. The user can choose the sample he wants to use for this project.
- **Existing Project:** no file will be added to the project. This option is useful when the user wants to create a new project using existing application code files. Existing files in ./src and ./inc will be added to the project.

**For this sample, the Hello_World Sample Project base will be used**

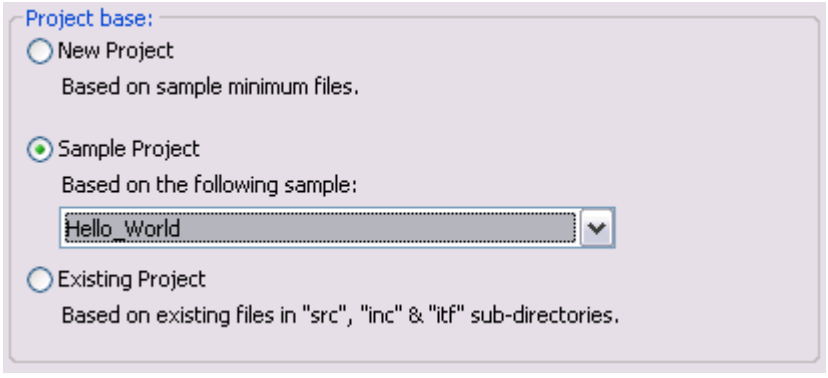



Figure 6 : Project base

Please note that when using the Sample Project base, the project name is automatically updated with the currently selected sample name.




Figure 7 : Project name is automatically updated

### 2.1.6 Step 6 : Development environment

In order to launch a supported development environment, this one has to be selected in the drop-down box (only installed environments are listed), and the Launch checkbox has to be clicked.




Figure 8 : Development environment selection


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### 2.1.7 Step 7 : Creating project

The project files creation process will start as soon as the OK button is clicked.

If the selected path does not exist, the Wizard will prompt the user to create the directory.

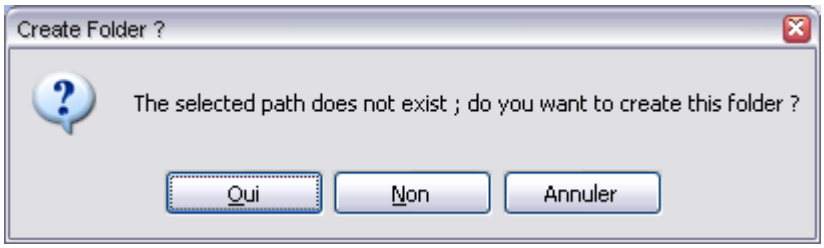



Figure 9 : Create folder message box

If the synchronization option for the selected Development Environment was not selected, it will be automatically set. The user will be informed with the following message box. Please refer to the Tools Manual for more information.




Figure 10 : Synchronization option is now enabled


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Then the project files creation process will start. Process evolution is displayed in a bash shell text window. At the end of the process, the Open AT® Project Wizard is closed, and the selected Development Environment is launched.

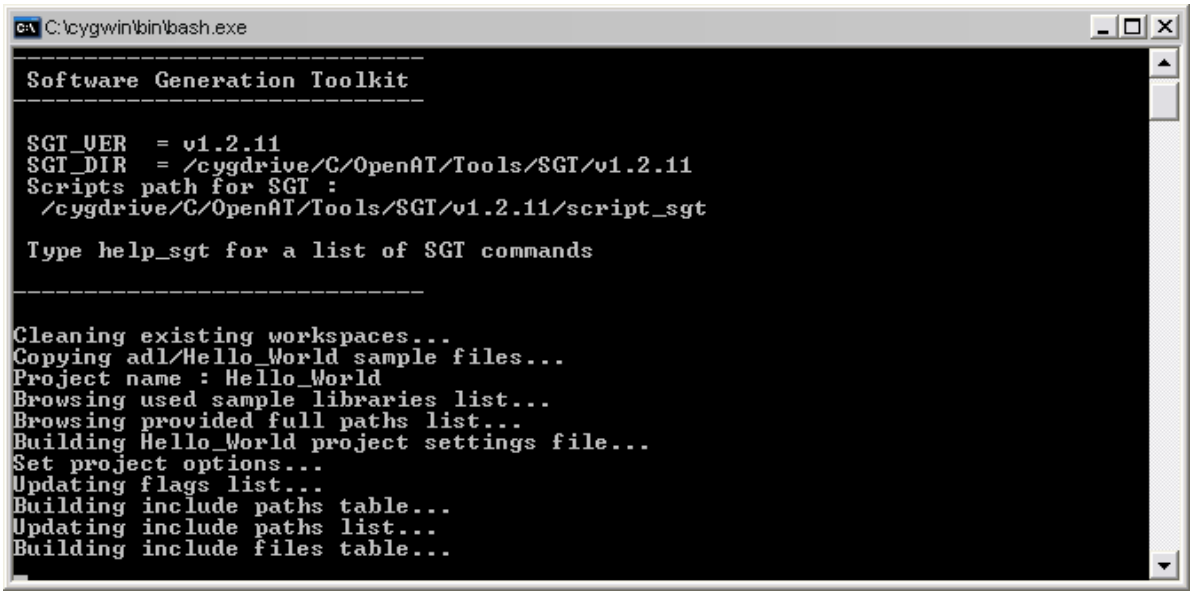



Figure 11 : Project files creation process

Note: If project creation problems are encountered, please refer to section 10 Annex: environment & compilation issues in the Tools Manual [2] to solve them.

## 2.2 Directory Architecture

The typical directory tree structure of the application generated by the Open AT® Project Wizard is shown below :

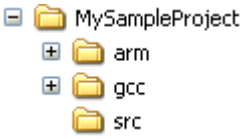



Figure 12 : Directory Structure


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The **"Root"** directory is the directory entered in the **"Location"** text field in the Open AT® Project Wizard step 2.

It is made up of the following sub-directories :

- **rte** : will contain the Remote Application binaries, which will be generated by a **"Build"** command,
- **arm/out** : will contain the Embedded Application Software binary (generated with the ARM compiler), ready to be downloaded into the Target,
- **gcc/out** : will contain the Embedded Application Software binary (generated with the GCC compiler), ready to be downloaded into the Target,
- **src** : contains the User Open AT® sources,

  For this example, the **"src"** directory contains one file :
  - hello_world.c
- **inc** : contains the User Open AT® headers,

  For this example, the **"inc"** directory contains no files.


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# 3 Generate and run Open AT® applications in Remote mode

## 3.1 Generate the Open AT® remote application

See the **Development Guides** and the **AT Command Interface** to create & develop the embedded application.

| With this example, an "Hello World" string is displayed on serial link and on Target Monitoring Tool. |
|---|

The remote application binary is generated as described in the **Tools Manual.**

### 3.1.1 Within Visual C++ 6.0

- Select the RTE (Remote Task Environment) project, and the Debug configuration from the build toolbar.




Figure 13 : RTE project & configuration selection (Visual C++ 6.0)

- Use the **"Build" -> "Build Hello_World_rte.dll"** command (or F7 key).

### 3.1.2 Within Visual C++ .NET

- Select the Debug configuration from the build toolbar.




Figure 14 : Configuration selection (Visual C++ .NET)

- In Visual C++ .NET, use the **"Build" -> "Build solution"** command (or Ctrl+Shift+B key combination).

If any compilation or link error occurs, please refer to section 10 Annex: environment & compilation issues in the Tools Manual [2] to solve them.


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## 3.2 Running the Remote Application

*In the Target Monitoring Tool*

Start the Target Monitoring Tool (from the Windows Start Menu).

Select **"Commands" -> "Auto Detect"** to detect the target speed (or use the toolbar button).

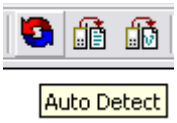



Figure 15 : Auto Detect toolbar button

Select **"Commands" -> "Init Target"** to initialize the target in debug mode (or use the toolbar button).

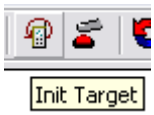



Figure 16 : Init Target toolbar button

Select **"Traces" -> "Open"** to open the trace window (or use the toolbar button), if it is not already opened.

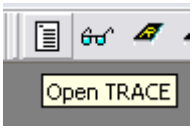



Figure 17 : Open TRACE toolbar button

Select **"Commands" -> "Get Informations About Target"** to initialize the trace mode (or use the toolbar button).

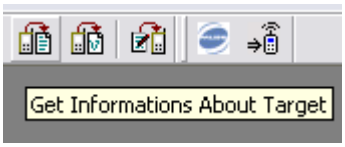



Figure 18 : Auto Detect toolbar button


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*In the Terminal Emulator*

From the Target Monitoring Tool toolbar, start the Terminal Emulator.

Type the **"AT"** command in the Terminal Emulator window.

The wireless CPU should answer the **"OK"** string, in blue characters. If not, check your target connection or check if another program is using the serial port. Then, retry the operation.

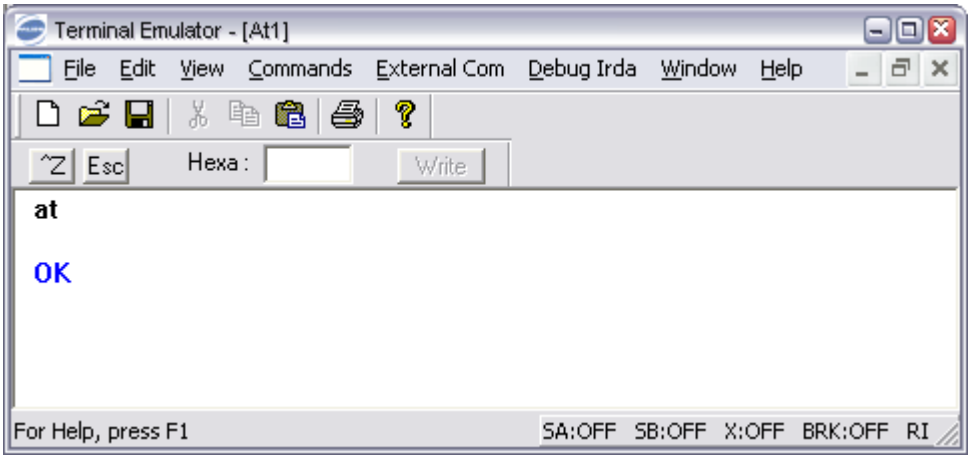



Figure 19 : Terminal Emulator

*In Visual C++ ®*

Launch the application with the F5 key or the command :

"**Build" -> "Start Debug" -> "Go"** in Visual C++ 6.0

**"Debug" -> "Start"** in Visual C++ .NET

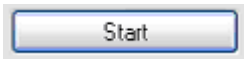
The Remote Application Controller window appears.


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*In the Remote Application Controller*

Select the **"CUSTOMER trace levels"** you want to show in the Target Monitoring Tool.

> For this example, the Hello World application uses Level 1 of CUS4 task. You can check this levels in the Remote Application Controller window.

Select the  button.

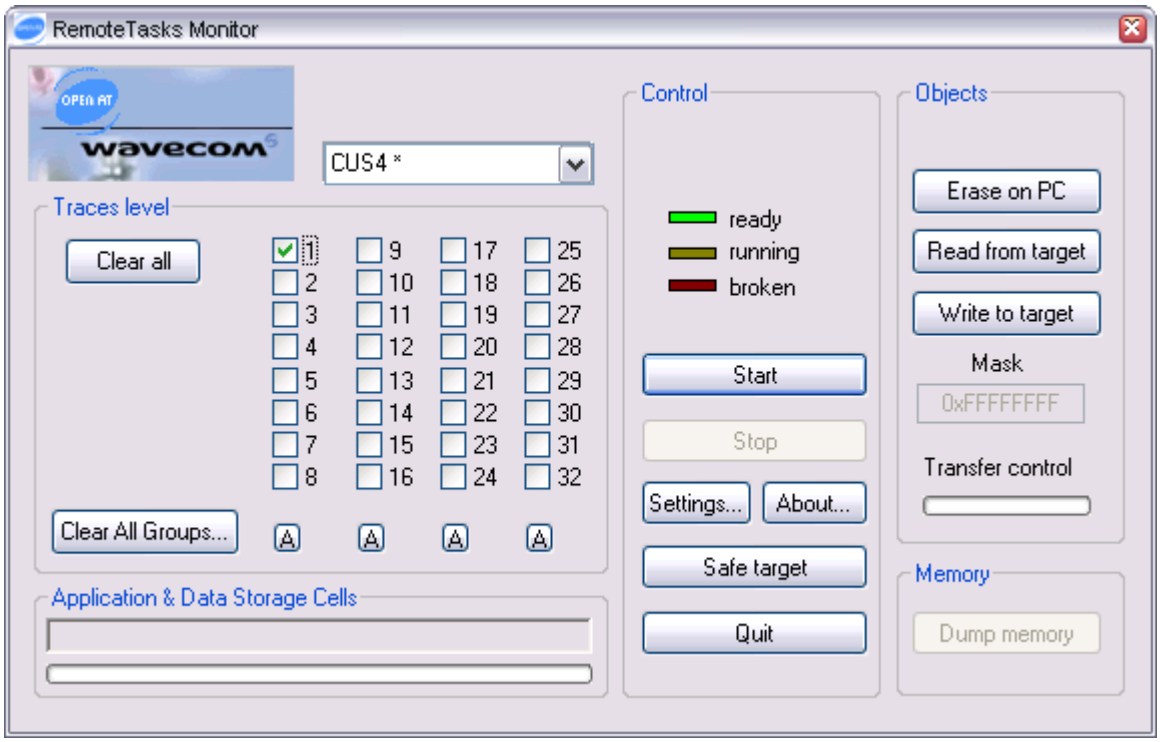




Figure 20 : RTE Monitor window


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*In the Target Monitoring Tool*

Traces should appear in blue in the trace window, indicating that the remote application is running.

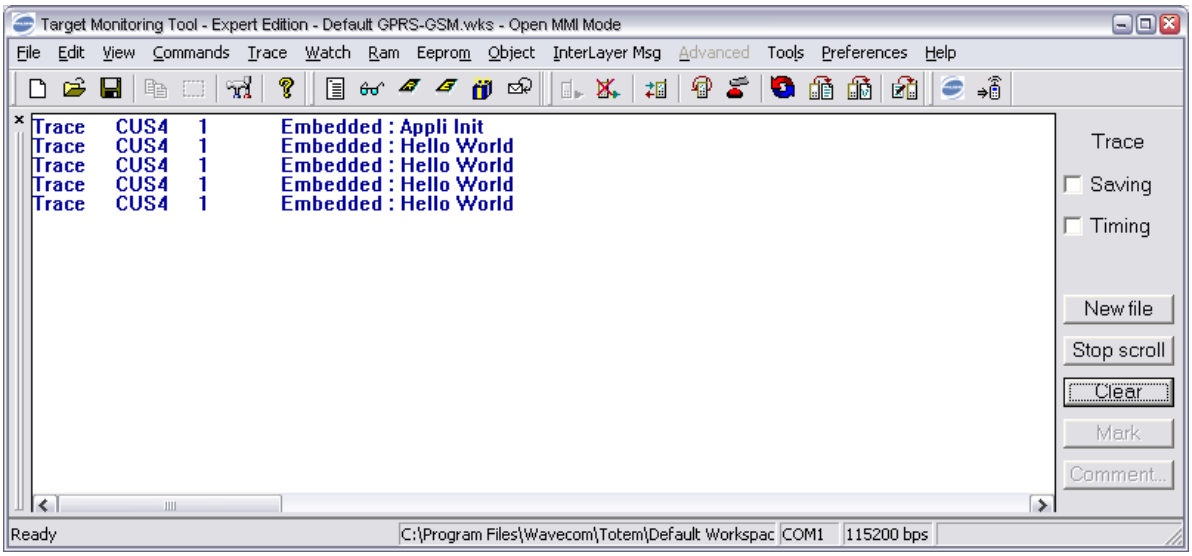



Figure 21 : Traces in Target Monitoring Tool

*In the Terminal Emulator*

The modem is ready to receive AT commands, and displays strings sent by the Open AT® application.

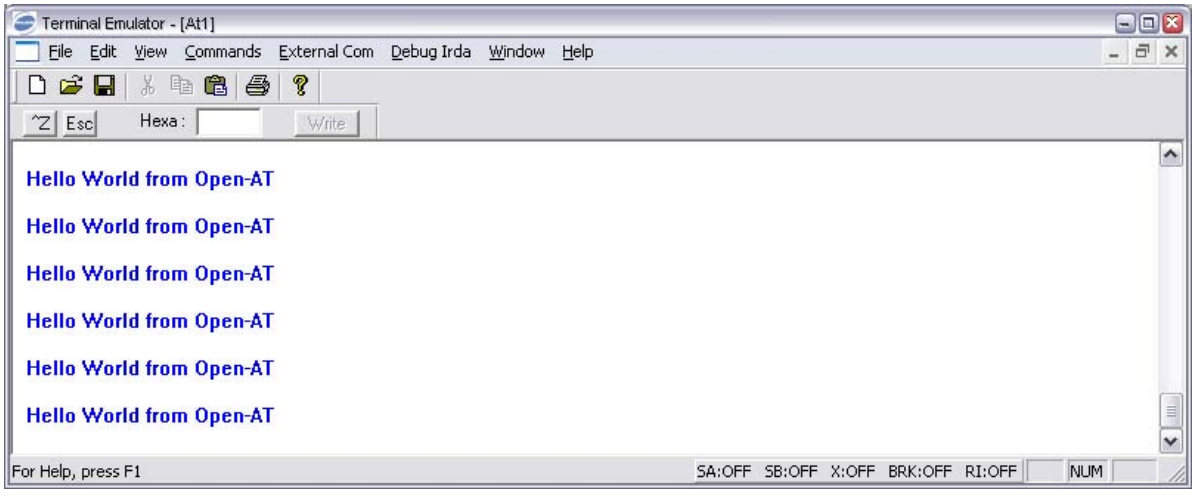



Figure 22 : Strings displayed in Terminal Emulator


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# 4 Generate and run Open AT® applications in Target mode

The target application binary is generated as described in the **Tools Manual.**

It may be generated using one of the supported IDE, or from the Cygwin command line.

## 4.1 Open AT® Settings

By default, the SDK is configured to build target applications with the ARM compiler.

These settings may be changed using the Open AT® Settings application, which may be started from the **"Start->Wavecom->Open AT->Open AT Settings"** shortcut.

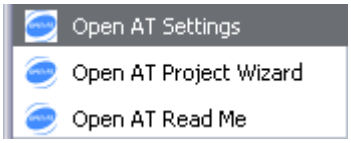



Figure 23 : Open AT® Settings shortcut in the Start menu

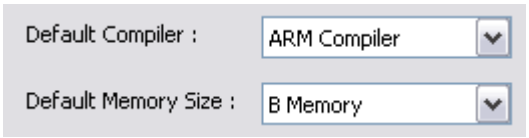



Figure 24 : Target settings


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## 4.2 Build target mode application using a Development Environment

### 4.2.1 Within Visual C++ 6.0

- Select the target project, and the Wismo_Target configuration from the build toolbar.

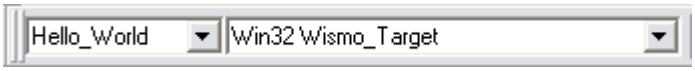



Figure 25 : Target project & configuration selection (Visual C++ 6.0)

- Use the **"Build" -> "Build Hello_World"** command (or F7 key).

### 4.2.2 Within Visual C++ .NET

- Select the Wismo Target configuration from the build toolbar.




Figure 26 : Configuration selection (Visual C++ .NET)

- In Visual C++ .NET, use the **"Build" -> "Build solution"** command (or Ctrl+Shift+B key combination).

If any compilation or link error occurs, correct them and restart the build operation.


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## 4.3 Build target mode applications from the Cygwin command line

- In a Cygwin command window, call the **"wmmake xxx"** command in the root directory, where **"xxx"** is the application makefile name (without the **".mak"** extension).

  For this example, call the **"wmmake Hello_World"** command, from the **"Hello_World"** directory.

- Check in the created **"[compiler]/out"** directory for the new **".obj"** compiled files. If a compilation error occurs, these ones will be displayed in the terminal window.

## 4.4 Generated binaries

Check in the **"[compiler]/out"** directory for the new **"[compiler]_Hello_World_[mem].wpb.dwl"** & **"[compiler]_Hello_World_[mem].dwl"** files.

Where :

- [compiler] is the current target compiler, selected in the Open AT® Settings application (arm or gcc) ;
- [mem] is the current target memory type, selected in the Open AT® Settings application.

These files are the Embedded Application binary, ready to be downloaded to the target.

The **".wpb.dwl"** one is a compressed version of the **".dwl"** one. This file will be smaller and so faster to download on the target.


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## 4.5 Download

In order to download the **".wpb.dwl"** file to the target, follow these steps:

1. Launch HyperTerminal;
2. Configure it to open the COM port (see following figures);




Figure 27 : Connection Type




Figure 28 : Phone Call Destination


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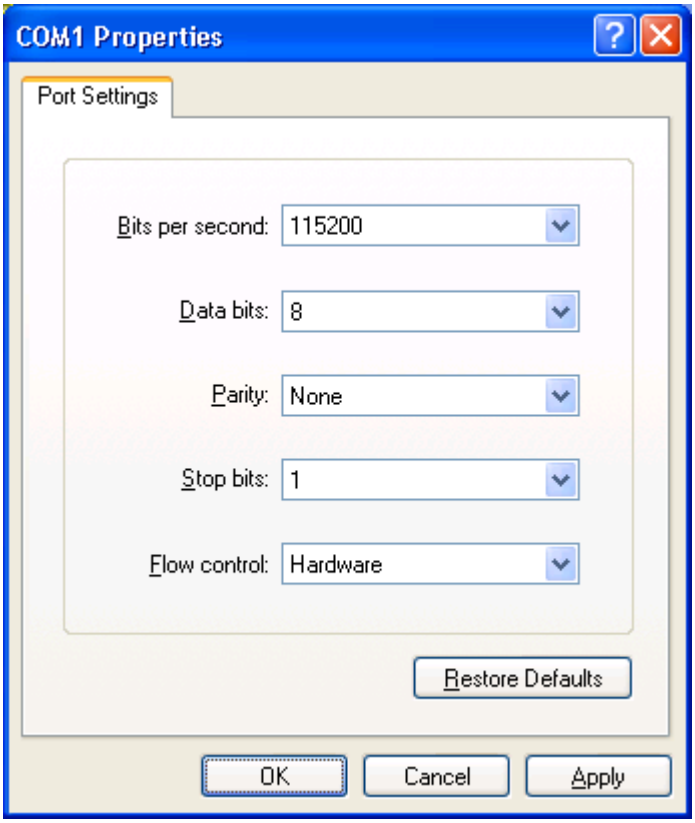



Figure 29 : COM1 Serial Port Features


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3. Type the **"AT"** command in the HyperTerminal window. The response must be **"OK"** (see figure below); The modem will echo characters on the serial link only if it is actually configured (In the figure, the **"aaaaaaa"** string is typed and the modem echoes it: the modem is connected);

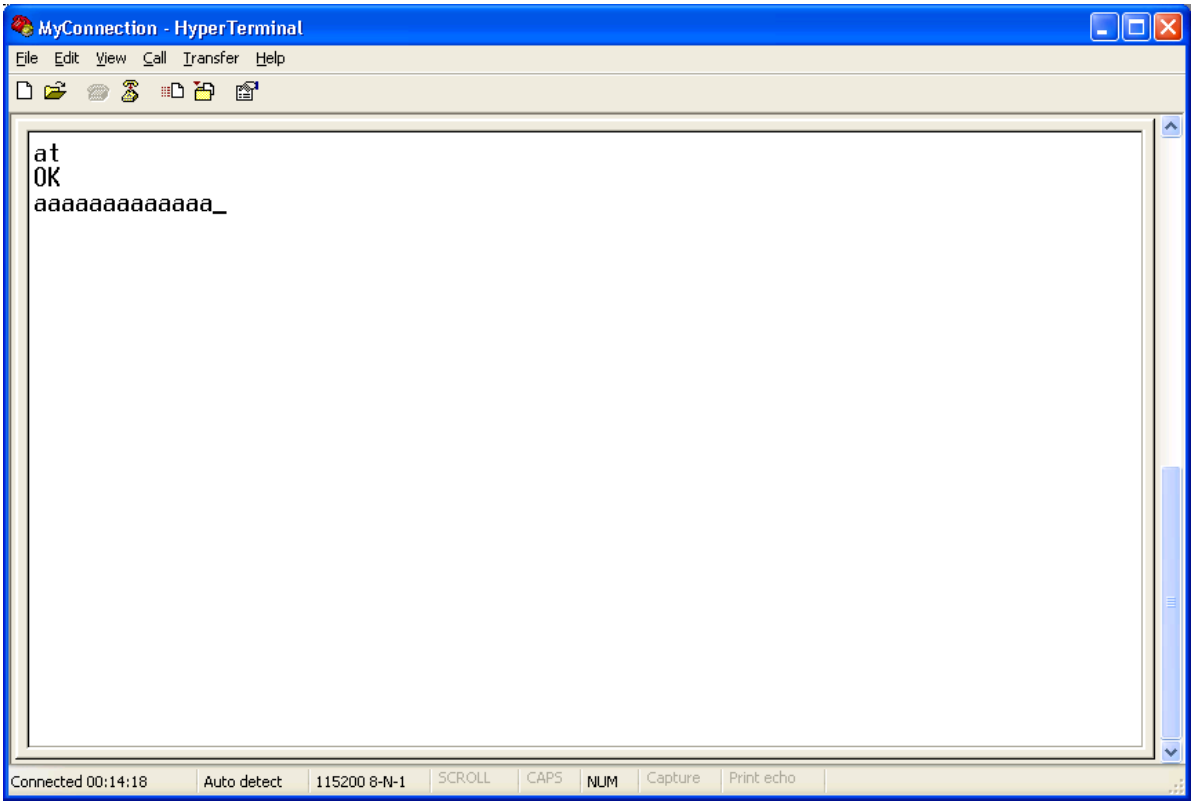



Figure 30 : Modem Connection Check


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4. Type the **"at+wdwl"** command to start the download mode. A **"+WDWL: 0"** response is given, and a set of characters should appear: the wireless CPU has acknowledged the download mode (see Figure below);

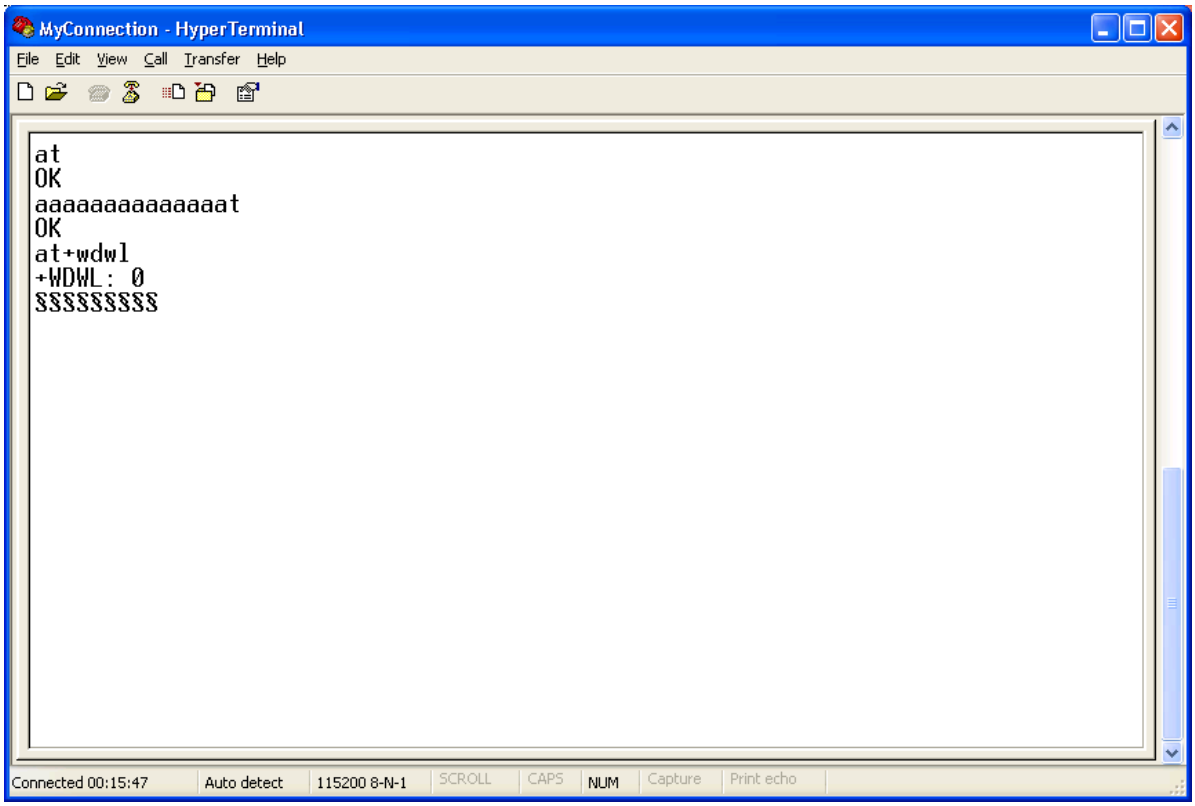



Figure 31 : File Download with HyperTerminal

5. From the **"Transfer"** menu, select **"Send a file..."** (see Figure 8);

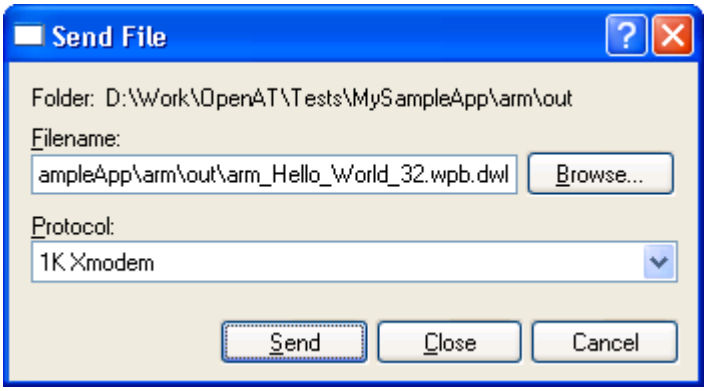



Figure 32 : File Selection


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6. Select the **"[compiler]/out/[compiler]_Hello_World_[mem].wpb.dwl"** file, and the **"1K Xmodem"** protocol. Press the **"Send"** button (see Figure below);

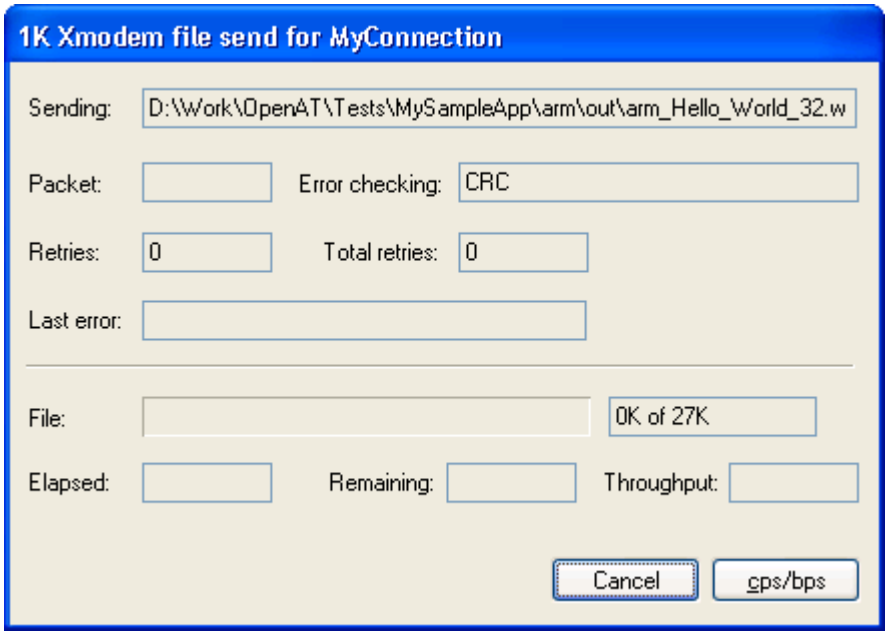



Figure 33 : Application Download process

7. As soon as the download process is terminated (the download window disappears), reset the target with the **"AT+CFUN=1"** command.


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## 4.6 Run the Embedded Application

### 4.6.1 With HyperTerminal

Type the **"at+wopen=1"** command, to start the embedded application (see **AT Commands Interface"** for more information).

Your application is now running in nominal mode.

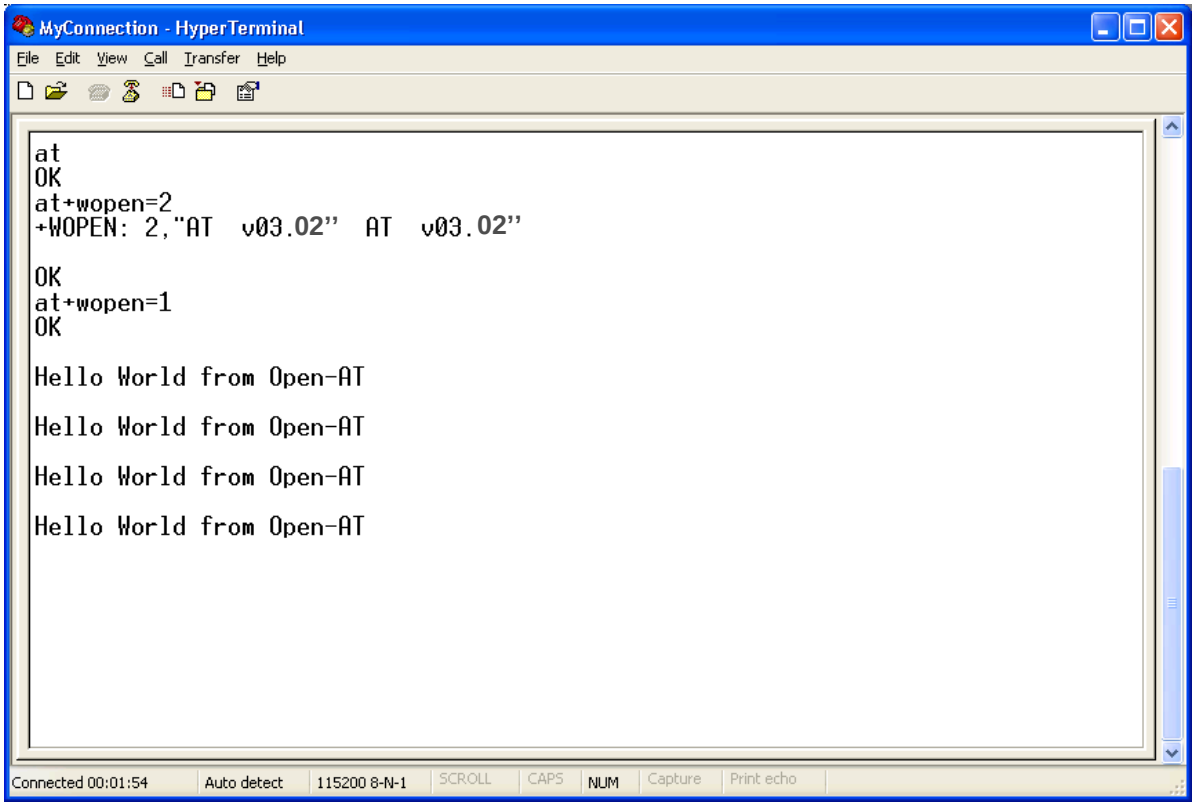



Figure 34 : Application is running on Hyper Terminal


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### 4.6.2 With the Terminal Emulator

Close the HyperTerminal program.

*In the Target Monitoring Tool*

Start the Target Monitoring Tool (from the Windows Start Menu).

Select **"Commands" -> "Auto Detect"** to detect the target speed (or use the toolbar button).

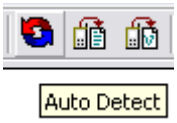



Figure 35 : Auto Detect toolbar button

Select **"Commands" -> "Init Target"** to initialize the target in debug mode (or use the toolbar button).

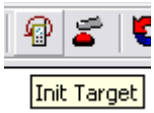



Figure 36 : Init Target toolbar button

Select **"Traces" -> "Open"** to open the trace window (or use the toolbar button), if it is not already opened.

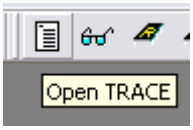



Figure 37 : Open TRACE toolbar button

Select **"Commands" -> "Get Informations About Target"** to initialize the trace mode (or use the toolbar button).

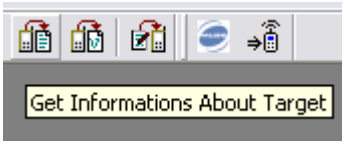



Figure 38 : Auto Detect toolbar button


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Select **"Traces" -> "Set Diagnose Levels."** Select **"CUS4"** in the **"Parameter"** list, check trace levels in the **"Bitmap"** zone, and use the **"Send Level"** button before closing the dialog box.




Figure 39 : Set and Request toolbar button

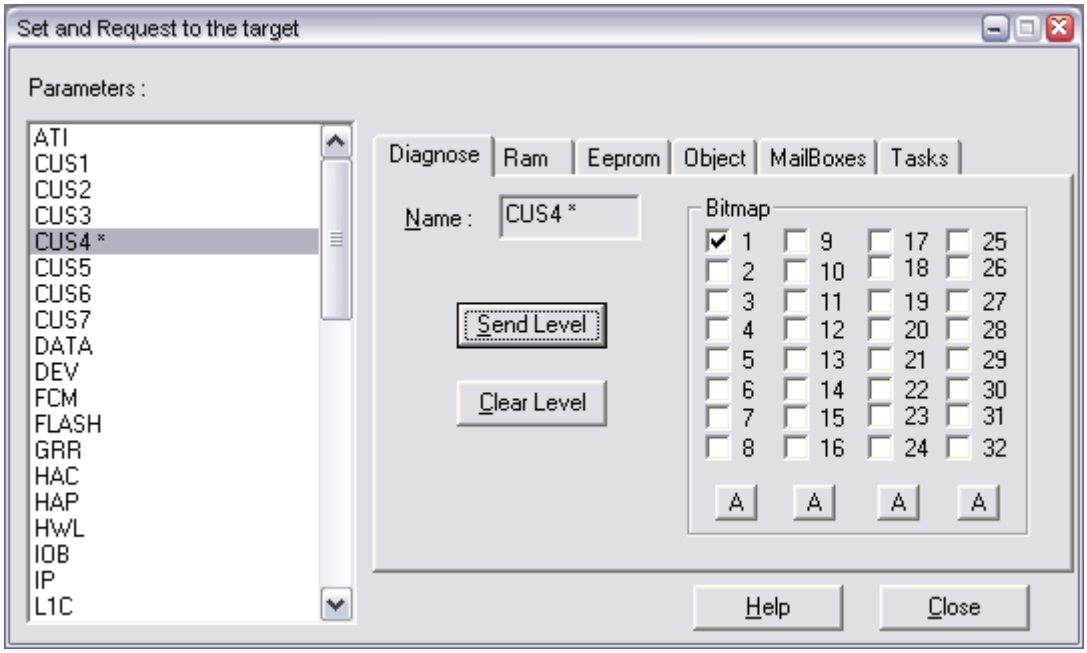



Figure 40 : Set and Request window

| For this example, the Hello World application uses Level 1, so check this levels in the Set Diagnostic Levels window. |
|---|

*In the Terminal Emulator*

From the Target Monitoring Tool toolbar, start the Terminal Emulator.

Type the **"at"** command in the Terminal Emulator AT window.

The wireless CPU should answer the **"OK"** string in blue characters. If not, check your target connection, or if another program using the serial port is not running, then retry the operation.

Type **"at+wopen=1"** command in the Terminal Emulator AT window (see **AT Commands Interface"** for more information).


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Since switching between 0 and 1 states of the +WOPEN command reset the product, re-launch an "init target" process, by the **Ctrl+I** key combination, or from the **"Commands->Init Target"** menu.

The wireless CPU is then ready to receive AT commands, and displays the strings sent by the embedded application.

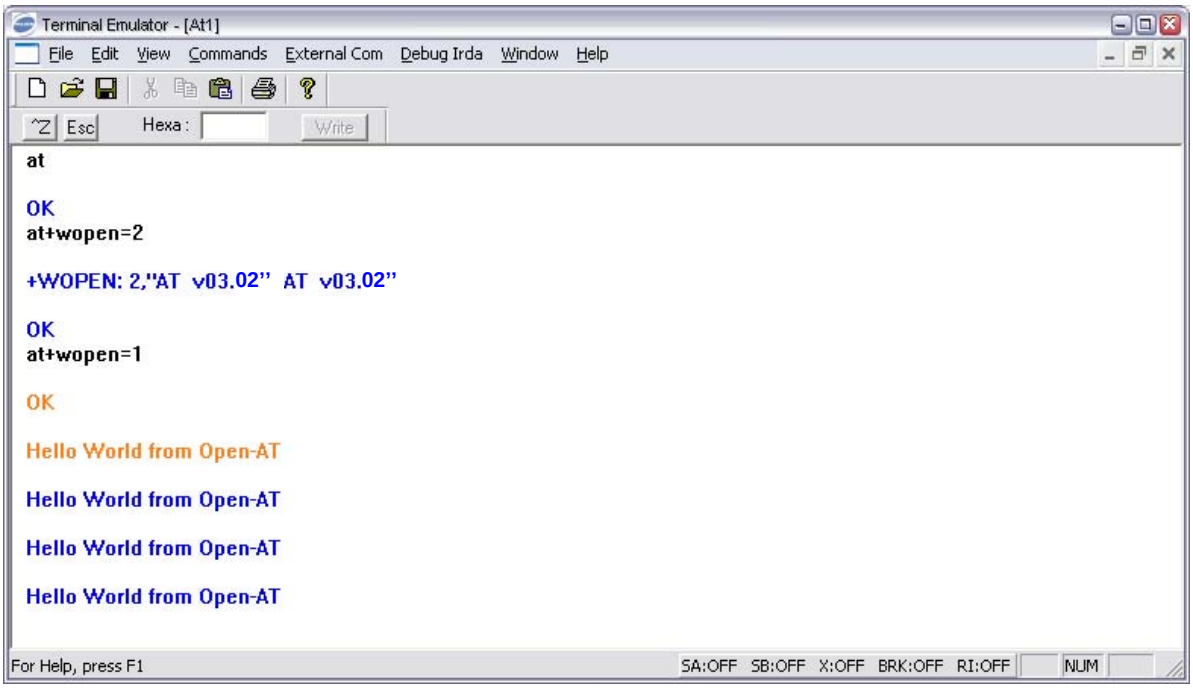



Figure 41 : Terminal emulator interface


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*In the Target Monitoring Tool*

Traces should appear in black in the trace window, indicating that the remote application is running.

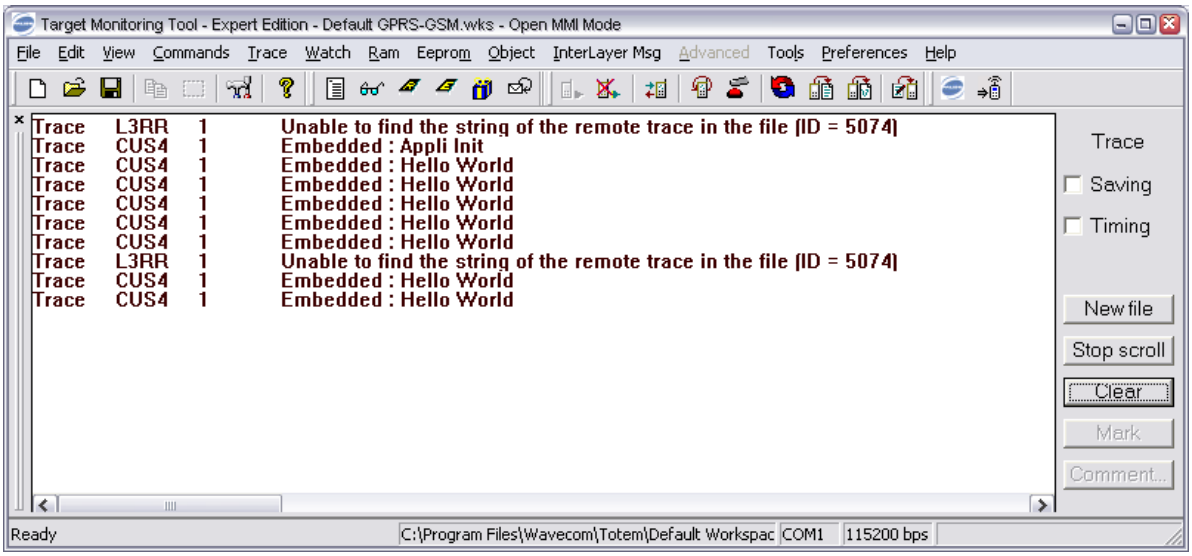
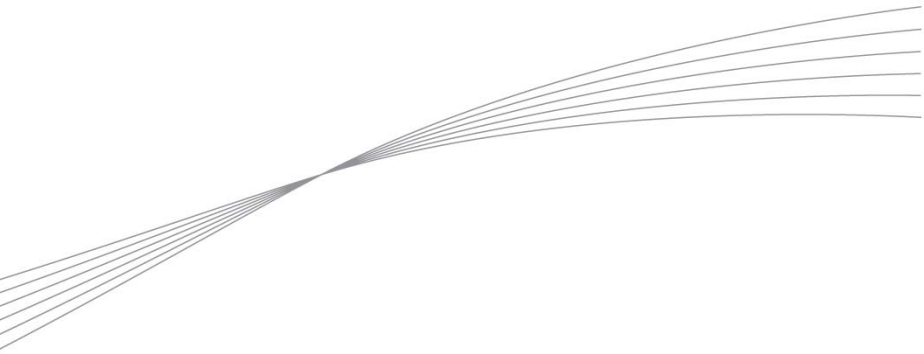



Figure 42 : Embedded application traces


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Make it wireless

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