



# Tutorial for Open AT<sup>®</sup> v3.03

Revision: 001  
Date: November 2005



**wavecom**<sup>®</sup>  
*Make it wireless*

# **Tutorial for Open AT<sup>®</sup> V3.03**

Revision: 001  
Date: 29<sup>th</sup> November 2005  
Reference: WM\_ASW\_OAT\_UGD\_00050


## Document History

Index	Date	Versions	
001	November 29 <sup>th</sup> 2005	Creation	

## Overview

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

## Trademarks

<sup>®</sup>, WAVECOM<sup>®</sup>, WISMO<sup>®</sup>, Open AT<sup>®</sup>, and certain other trademarks and logos appearing on this document, are filed or registered trademarks of Wavecom S.A. in France or in other countries. All other company and/or product names mentioned may be filed or registered trademarks of their respective owners.

## Copyright

This manual is copyrighted by WAVECOM with all rights reserved. No part of this manual may be reproduced in any form without the prior written permission of WAVECOM.

No patent liability is assumed with respect to the use of the information contained herein.

# Table of Contents

<b>1</b>	<b>INTRODUCTION</b>	<b>8</b>
1.1	References.....	8
1.2	Glossary .....	8
1.3	Abbreviations .....	9
<b>2</b>	<b>CREATE APPLICATIONS WITH THE OPEN AT<sup>®</sup> PROJECT WIZARD</b>	<b>10</b>
2.1	Creating an application with the Open AT <sup>®</sup> Project Wizard .....	10
2.1.1	Step 1 : Launching the Open AT <sup>®</sup> Project Wizard .....	10
2.1.2	Step 2 : Project location.....	11
2.1.3	Step 3 : Project API.....	12
2.1.4	Step 4 : Project Type .....	12
2.1.5	Step 5 : Project Base .....	12
2.1.6	Step 6 : Development environment.....	13
2.1.7	Step 7 : Creating project.....	14
2.2	Directory Architecture .....	15
<b>3</b>	<b>GENERATE AND RUN OPEN AT<sup>®</sup> APPLICATIONS IN REMOTE MODE</b>	<b>17</b>
3.1	Generate the Open AT <sup>®</sup> remote application.....	17
3.1.1	Within Visual C++ 6.0 .....	17
3.1.2	Within Visual C++ .NET.....	17
3.2	Running the Remote Application .....	18
<b>4</b>	<b>GENERATE AND RUN OPEN AT<sup>®</sup> APPLICATIONS IN TARGET MODE</b>	<b>22</b>
4.1	Open AT <sup>®</sup> Settings.....	22
4.2	Build target mode application using a Development Environment .....	23
4.2.1	Within Visual C++ 6.0 .....	23
4.2.2	Within Visual C++ .NET.....	23
4.3	Build target mode applications from the Cygwin command line .....	24
4.4	Generated binaries .....	24
4.5	Download.....	25
4.6	Run the Embedded Application .....	30
4.6.1	With HyperTerminal.....	30
4.6.2	With the Terminal Emulator.....	31

## LIST OF FIGURES

Figure 1: Open AT <sup>®</sup> Project Wizard shortcut in the Start menu .....	10
Figure 2: Open AT <sup>®</sup> Project Wizard .....	11
Figure 3: Project path .....	11
Figure 4 : Project API.....	12
Figure 5 : Project type .....	12
Figure 6 : Project base.....	13
Figure 7 : Project name is automatically updated .....	13
Figure 8 : Development environment selection .....	13
Figure 9 : Create folder message box .....	14
Figure 10 : Synchronization option is now enabled .....	14
Figure 11 : Project files creation process .....	15
Figure 12 : Directory Structure .....	15
Figure 13 : RTE project & configuration selection (Visual C++ 6.0).....	17
Figure 14 : Configuration selection (Visual C++ .NET) .....	17
Figure 15 : Auto Detect toolbar button .....	18
Figure 16 : Init Target toolbar button.....	18
Figure 17 : Open TRACE toolbar button .....	18
Figure 18 : Auto Detect toolbar button .....	18
Figure 19 : Terminal Emulator .....	19
Figure 20 :RTE Monitor window .....	20
Figure 21 :Traces in Target Monitoring Tool.....	21
Figure 22 :Strings displayed in Terminal Emulator .....	21
Figure 23: Open AT <sup>®</sup> Settings shortcut in the Start menu.....	22
Figure 24: target compiler & memory size settings.....	22
Figure 25 : Target project & configuration selection (Visual C++ 6.0) .....	23
Figure 26 : Configuration selection (Visual C++ .NET) .....	23
Figure 27 : Connection Type.....	25
Figure 28 : Phone Call Destination.....	25
Figure 29 : COM1 Serial Port Features .....	26
Figure 30 : Modem Connection Check.....	27
Figure 31 : File Download with HyperTerminal.....	28

29th November 2005

Figure 32 : File Selection .....	28
Figure 33 : Application Download process .....	29
Figure 34 : Application is running on Hyper Terminal.....	30
Figure 35 : Auto Detect toolbar button .....	31
Figure 36 : Init Target toolbar button.....	31
Figure 37 : Open TRACE toolbar button .....	31
Figure 38 : Auto Detect toolbar button .....	31
Figure 39 : Set and Request toolbar button .....	32
Figure 40 : Set and Request window .....	32
Figure 41 : Terminal emulator interface .....	33
Figure 42 : Embedded application traces.....	34



# 1 Introduction

## 1.1 References

[DocRef1]	Open AT <sup>®</sup> Basic Development Guide (ref WM_ASW_OAT_UGD_00052 Revision 001)
[DocRef2]	Tools Manual (ref WM_TOO_OAT_UGD_00051 revision 001)
[DocRef3]	AT Command Interface Guide (ref WM_ASW_OAT_UGD_016 revision 6)

## 1.2 Glossary

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

### 1.3 Abbreviations

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

## **2 Create Applications with the Open-AT<sup>®</sup> Project Wizard**

### **2.1 Creating an application with the Open AT<sup>®</sup> Project Wizard**

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

#### **2.1.1 Step 1 : Launching the Open AT<sup>®</sup> Project Wizard**

The Open AT<sup>®</sup> Project Wizard may be launched from the “Start->Wavecom->Open AT->Open AT Project Wizard” shortcut.

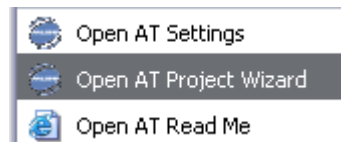


Figure 1: Open AT<sup>®</sup> Project Wizard shortcut in the Start menu

The Open AT<sup>®</sup> Project Wizard window is then displayed.

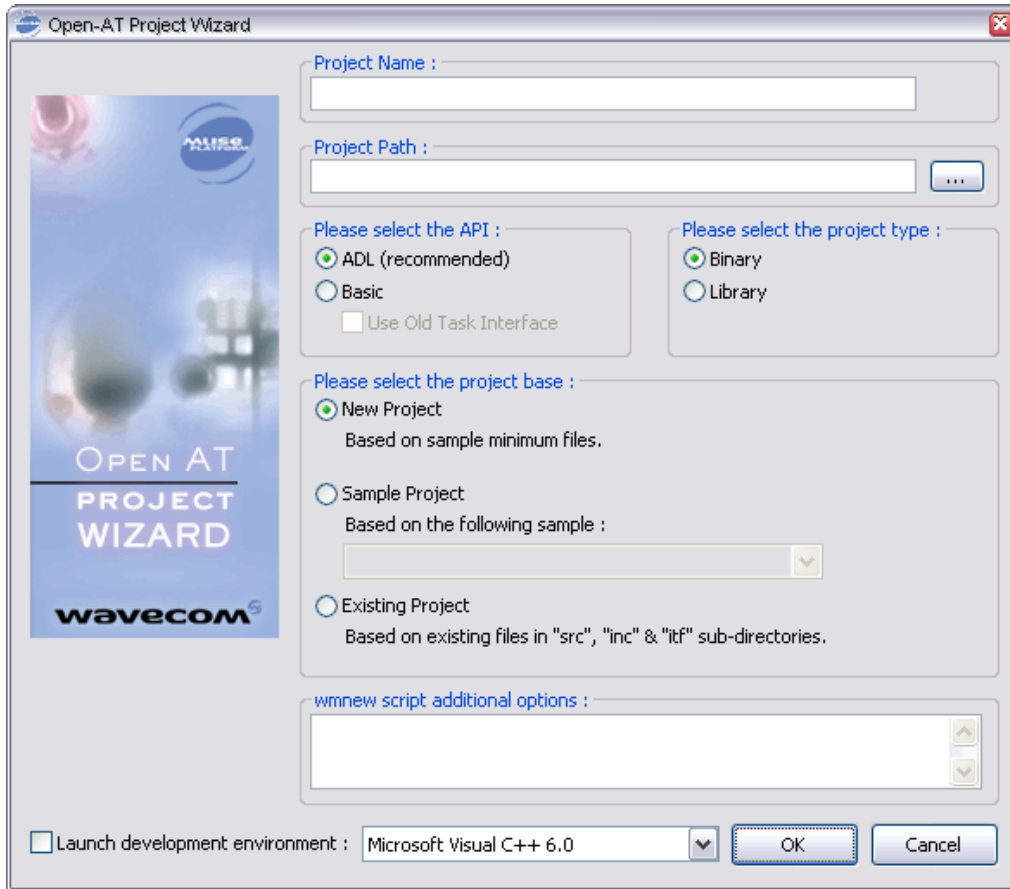



Figure 2: Open AT<sup>®</sup> Project Wizard

### 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).

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.

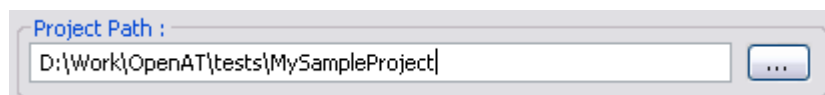


Figure 3: Project path

### 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.

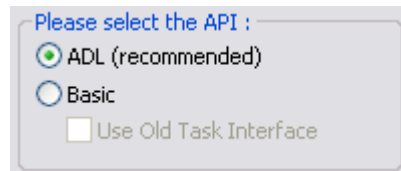


Figure 4 : Project API

### 2.1.4 Step 4 : Project Type

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

For this sample, the Binary type will be kept.

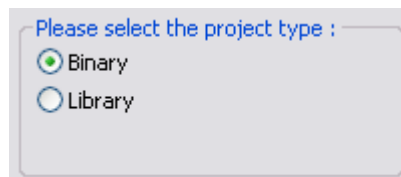


Figure 5 : Project type

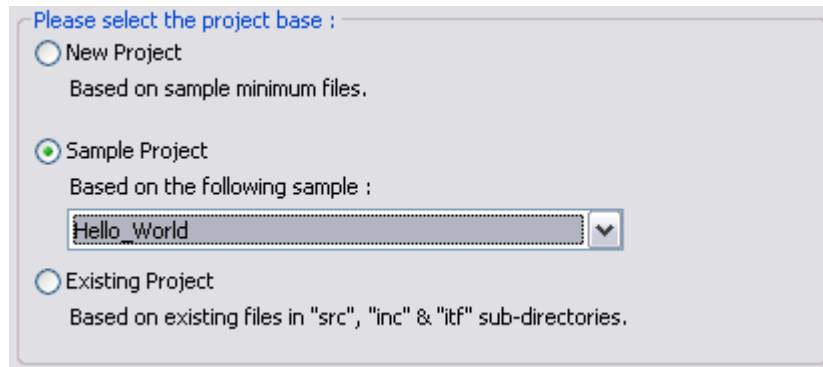
### 2.1.5 Step 5 : Project Base

Open AT<sup>®</sup> 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<sup>®</sup> 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.

29th November 2005

For this sample, the Hello\_World Sample Project base will be used



Please select the project base :

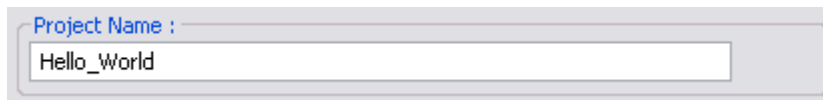
New Project  
Based on sample minimum files.

Sample Project  
Based on the following sample :  
Hello\_World

Existing Project  
Based on existing files in "src", "inc" & "itf" sub-directories.

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.



Project Name :  
Hello\_World

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.



Launch development environment : Microsoft Visual C++ 6.0

Figure 8 : Development environment selection

29th November 2005

**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.

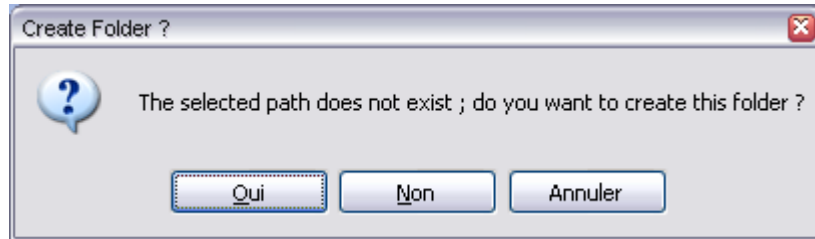


Figure 9 : Create folder message box

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.

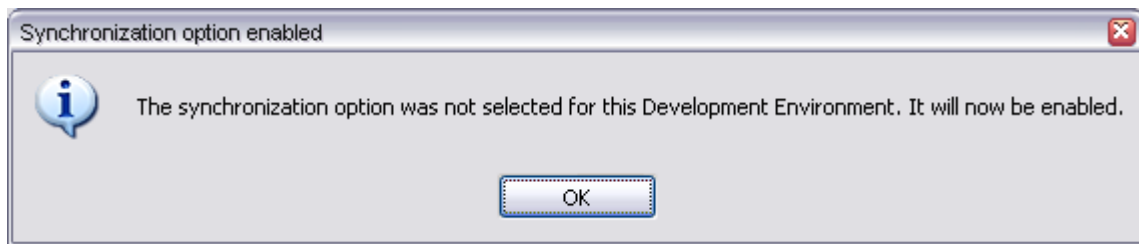
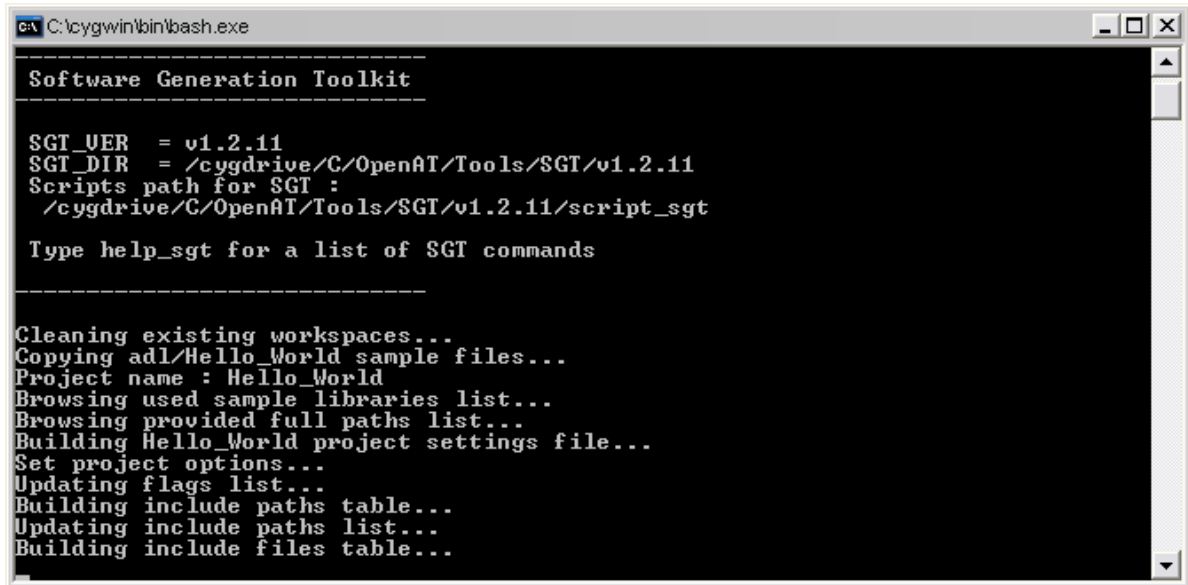


Figure 10 : Synchronization option is now enabled

29th November 2005

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<sup>®</sup> Project Wizard is closed, and the selected Development Environment is launched.



```
C:\cygwin\bin\bash.exe
-----
Software Generation Toolkit
-----
SGT_VER  = v1.2.11
SGT_DIR  = /cygdrive/C/OpenAT/Tools/SGT/v1.2.11
Scripts path for SGT :
/cygdrive/C/OpenAT/Tools/SGT/v1.2.11/script_sgt
Type help_sgt for a list of SGT commands
-----
Cleaning existing workspaces...
Copying adl/Hello_World sample files...
Project name : Hello_World
Browsing used sample libraries list...
Browsing provided full paths list...
Building Hello_World project settings file...
Set project options...
Updating flags list...
Building include paths table...
Updating include paths list...
Building include files table...
```

Figure 11 : Project files creation process

## 2.2 Directory Architecture

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

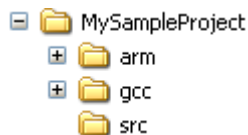


Figure 12 : Directory Structure



29th November 2005

The "**Root**" directory is the directory entered in the "**Location**" text field in the Open AT<sup>®</sup> 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<sup>®</sup> sources,

For this example, the "**src**" directory contains one file :

- hello\_world.c

- ❑ **inc** : contains the User Open AT<sup>®</sup> headers,

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

## 3 Generate and run Open AT<sup>®</sup> applications in Remote mode

### 3.1 Generate the Open AT<sup>®</sup> 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.

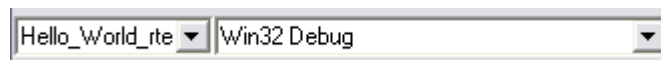


Figure 13 : RTE project & configuration selection (Visual C++ 6.0)

- 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, correct them and restart the build operation.

### 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).

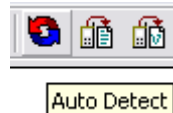


Figure 15 : Auto Detect toolbar button

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.

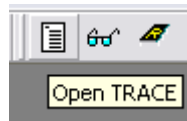


Figure 17 : Open TRACE toolbar button

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

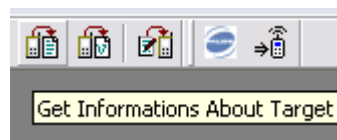


Figure 18 : Auto Detect toolbar button

29th November 2005

*In the Terminal Emulator*

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

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

The module 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.

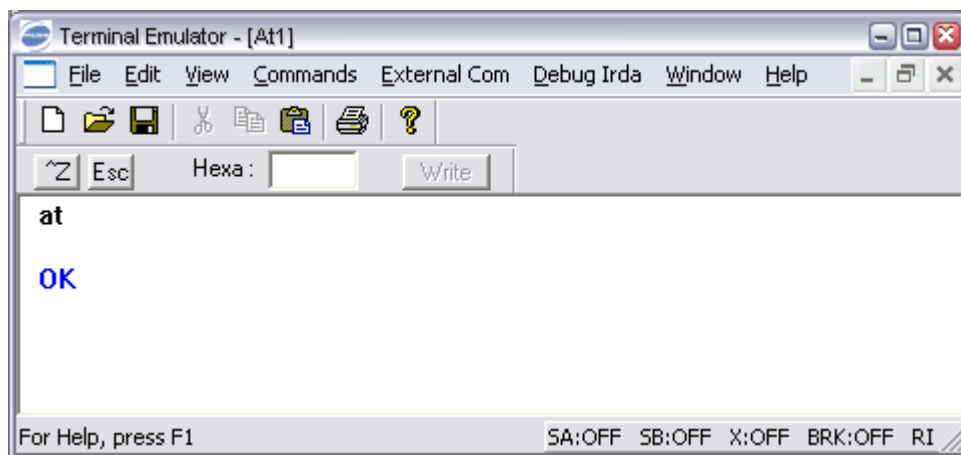


Figure 19 : Terminal Emulator

*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

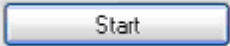
The Remote Application Controller window appears.

29th November 2005

### 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.

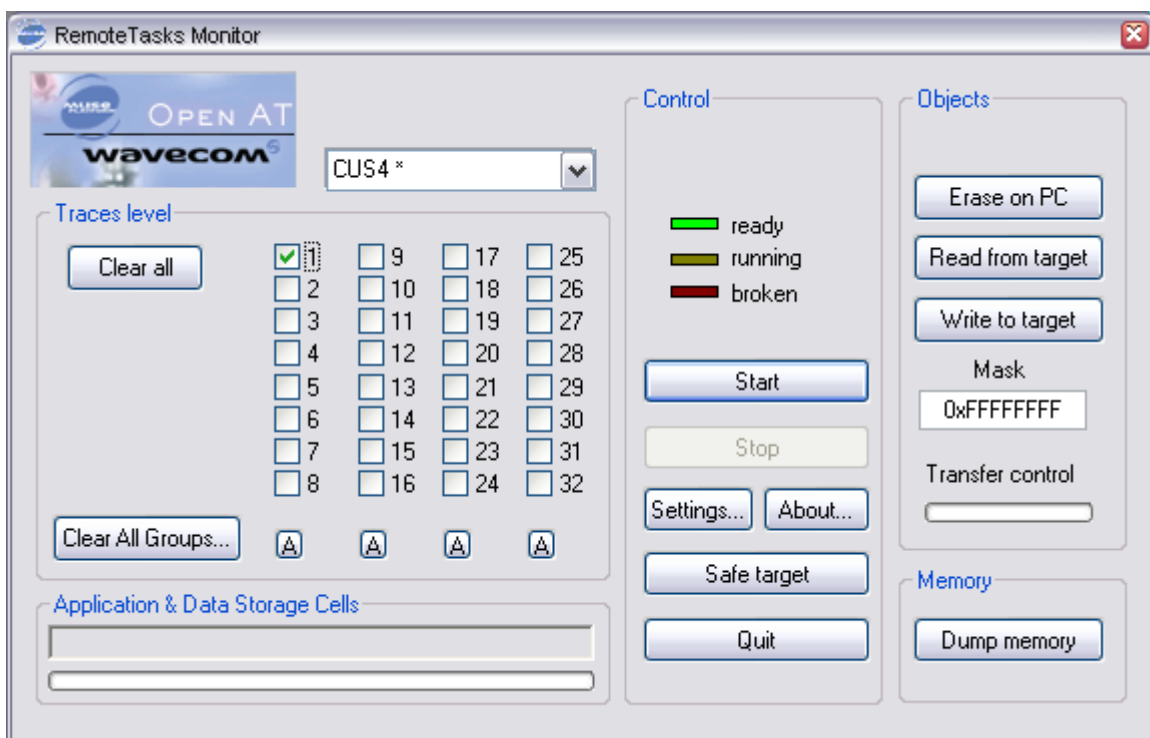


Figure 20 :RTE Monitor window

29th November 2005

*In the Target Monitoring Tool*

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

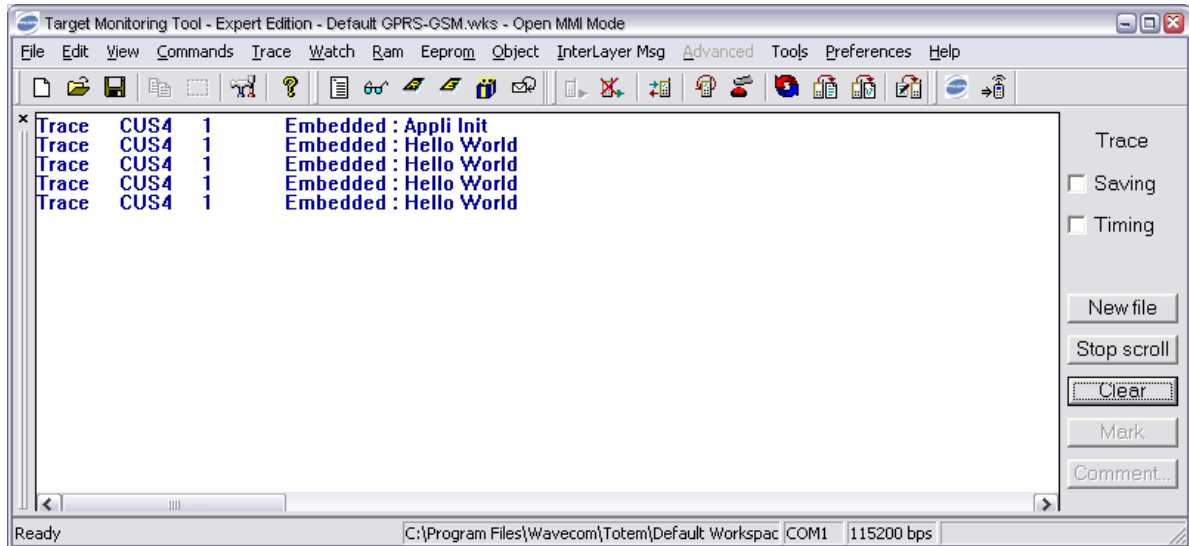


Figure 21 :Traces in Target Monitoring Tool

*In the Terminal Emulator*

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

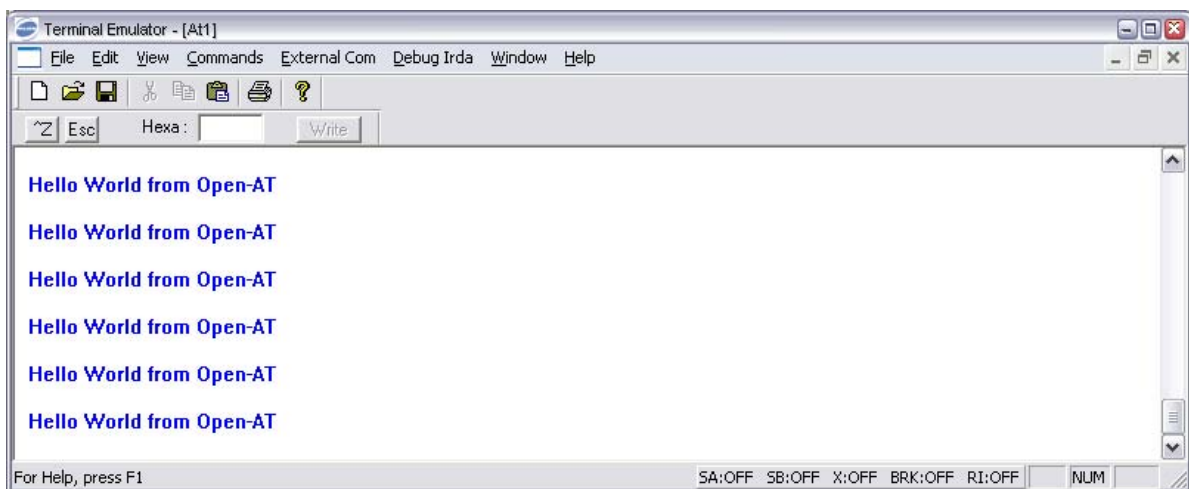


Figure 22 :Strings displayed in Terminal Emulator

## 4 Generate and run Open AT<sup>®</sup> 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<sup>®</sup> Settings

By default, the SDK is configured to build target applications with the ARM compiler, for B memory size products.

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

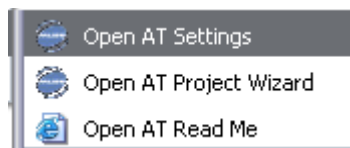


Figure 23: Open AT<sup>®</sup> Settings shortcut in the Start menu

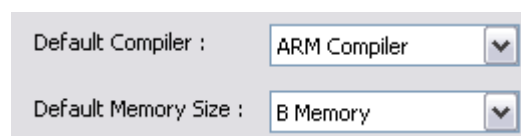


Figure 24: target compiler & memory size settings

29th November 2005

## 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.

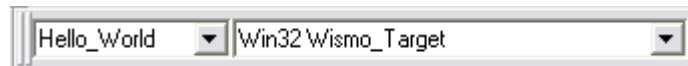


Figure 25 : Target project & configuration selection (Visual C++ 6.0)

- 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.



29th November 2005

### 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 <b>"wmmake Hello_World"</b> command, from the <b>"Hello_World"</b> 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<sup>®</sup> Settings application (arm or gcc) ;
- [mem] is the current target memory size, selected in the Open AT<sup>®</sup> Settings application (16, 32 or 32W).

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.

## 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

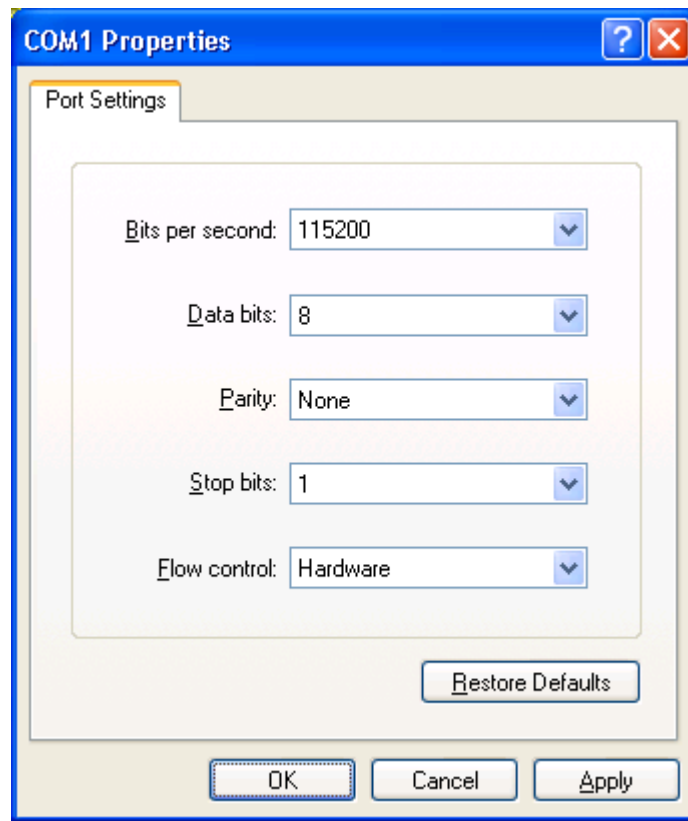


Figure 29 : COM1 Serial Port Features

29th November 2005

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);

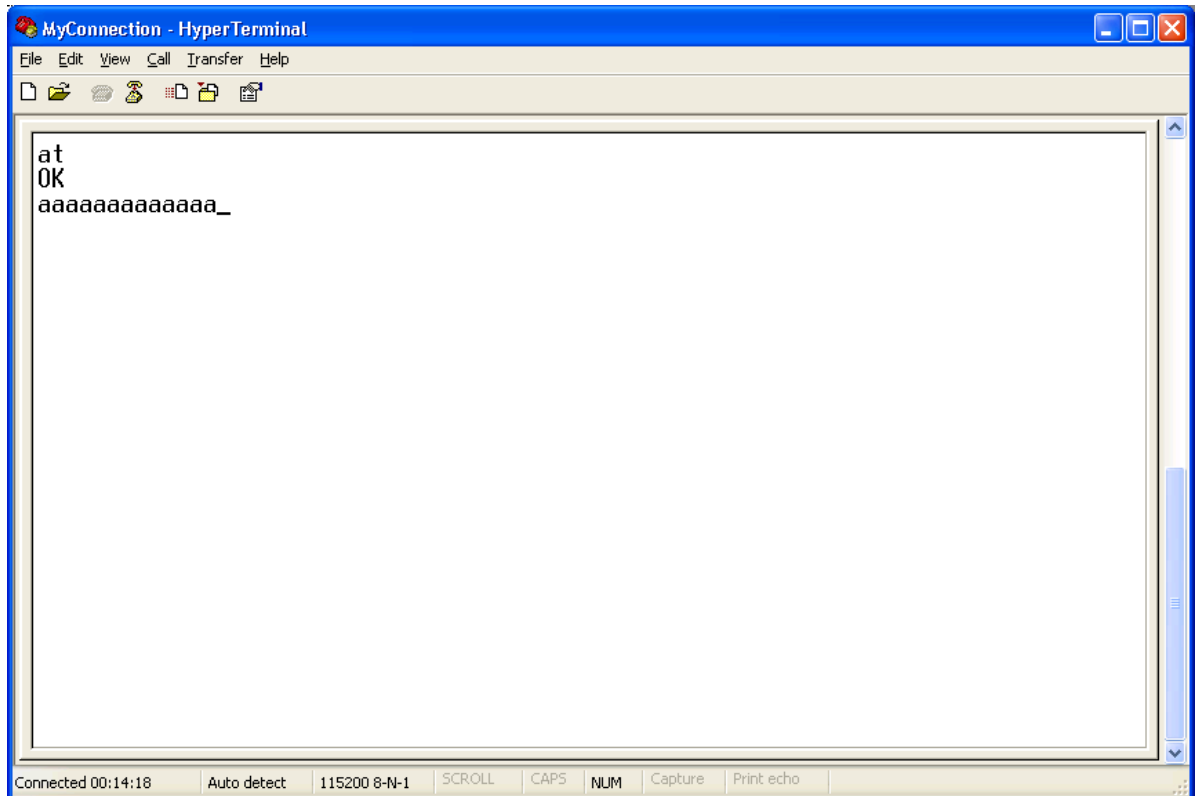


Figure 30 : Modem Connection Check

29th November 2005

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 module has acknowledged the download mode (see Figure below);

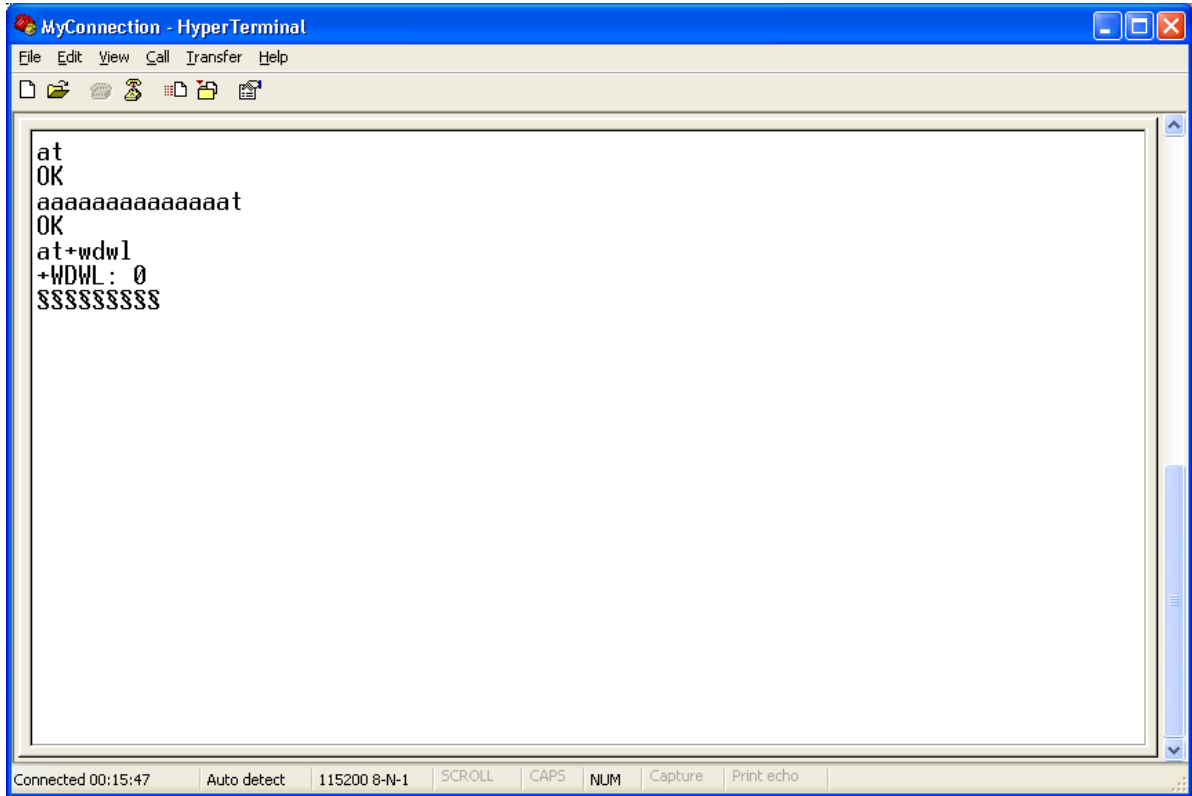


Figure 31 : File Download with HyperTerminal

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

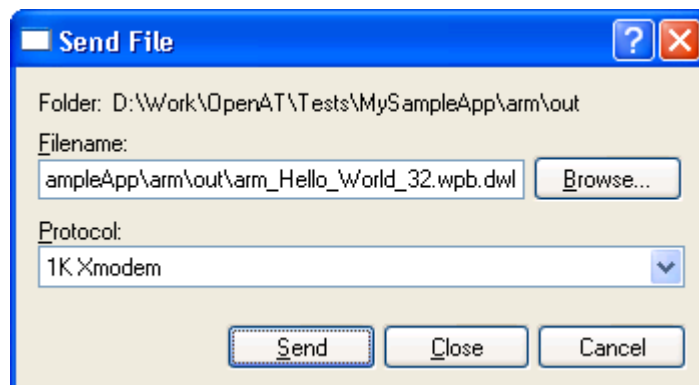


Figure 32 : File Selection

29th November 2005

6. Select the “[compiler]/out/[compiler]\_Hello\_World\_[mem].wpb.dwl” file, and the “1K Xmodem” protocol. Press the “Send” button (see Figure below);

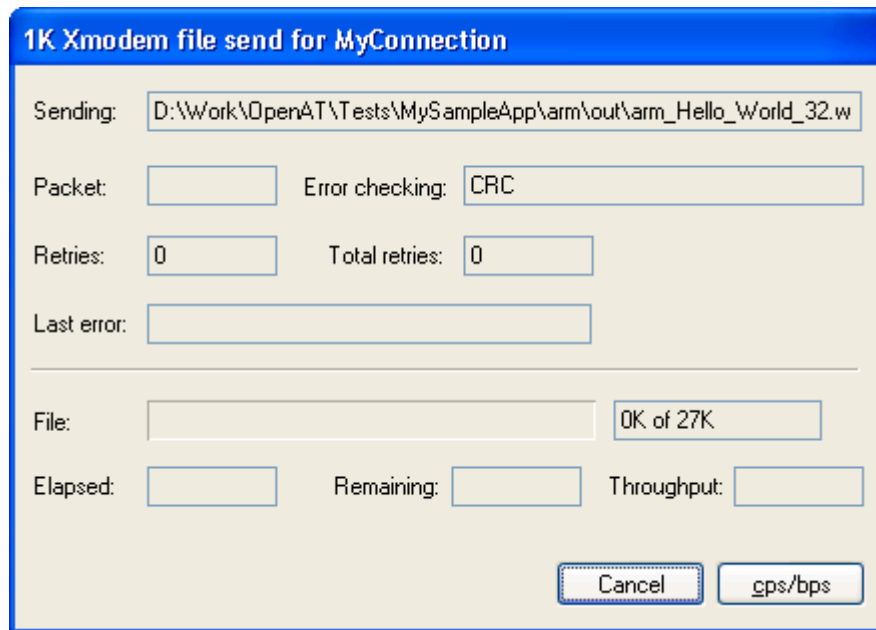


Figure 33 : Application Download process

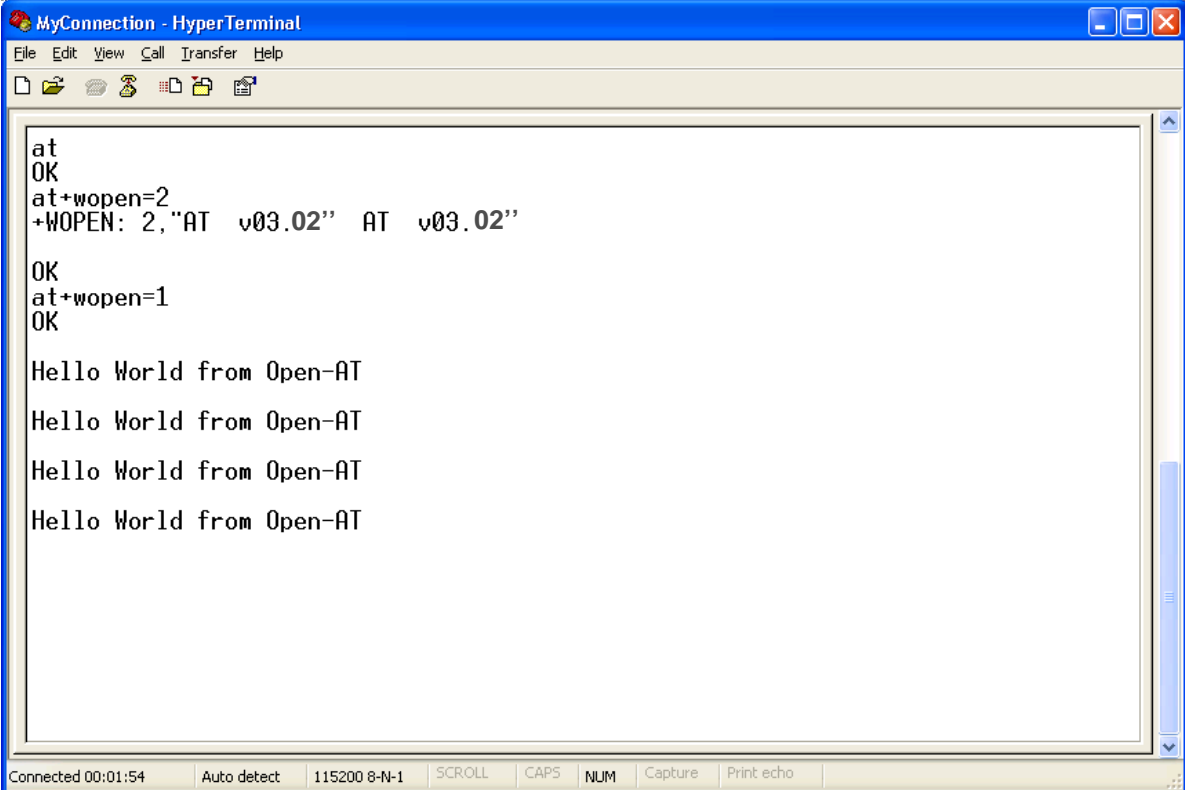
7. As soon as the download process is terminated (the download window disappears), reset the target with the “AT+CFUN=1” command.

## 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.



```
at
OK
at+wopen=2
+WOPEN: 2, "AT v03.02" AT v03.02"
OK
at+wopen=1
OK
Hello World from Open-AT
Hello World from Open-AT
Hello World from Open-AT
Hello World from Open-AT
```

Figure 34 : Application is running on Hyper Terminal

#### 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).

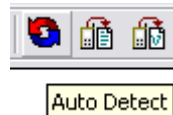


Figure 35 : Auto Detect toolbar button

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

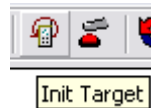


Figure 36 : Init Target toolbar button

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

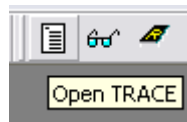


Figure 37 : Open TRACE toolbar button

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

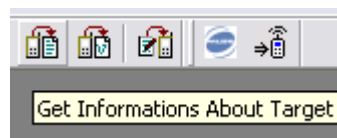


Figure 38 : Auto Detect toolbar button



29th November 2005

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

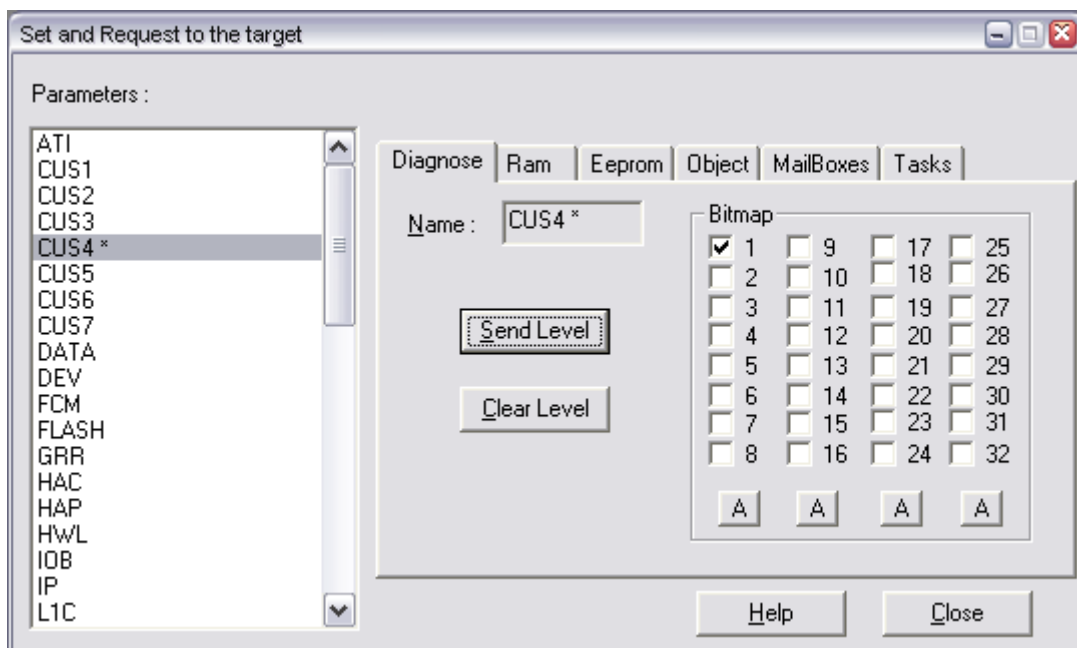


Figure 40 : Set and Request window

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 module 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).

29th November 2005

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

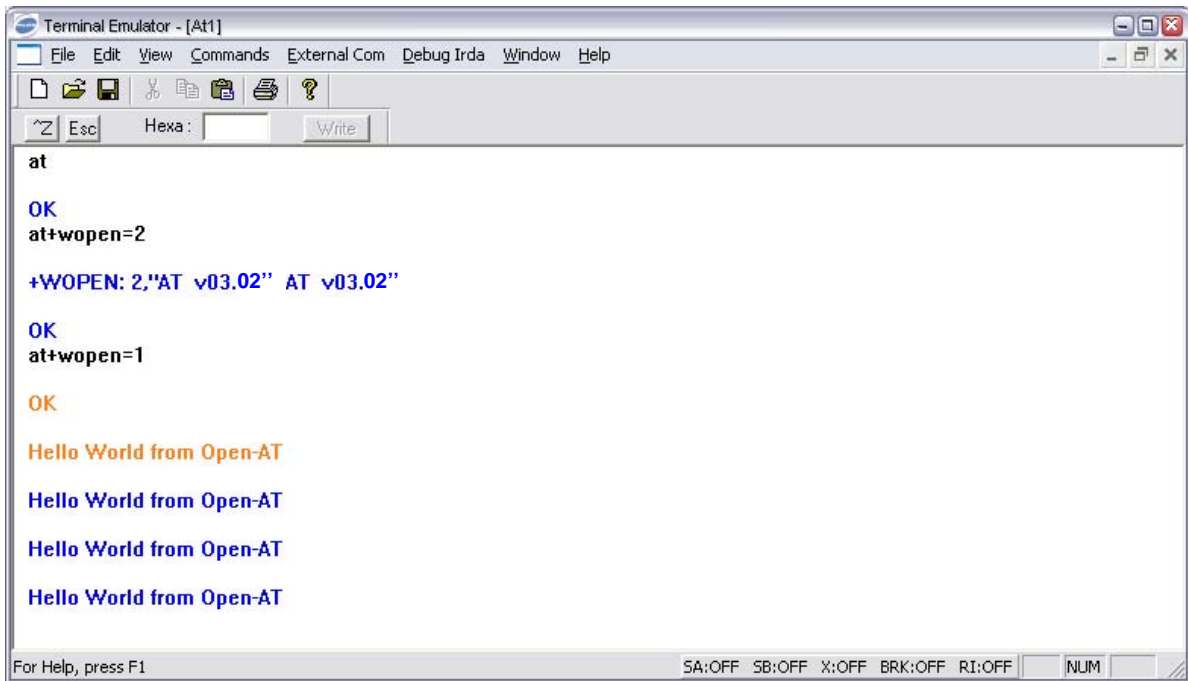


Figure 41 : Terminal emulator interface

29th November 2005

*In the Target Monitoring Tool*

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

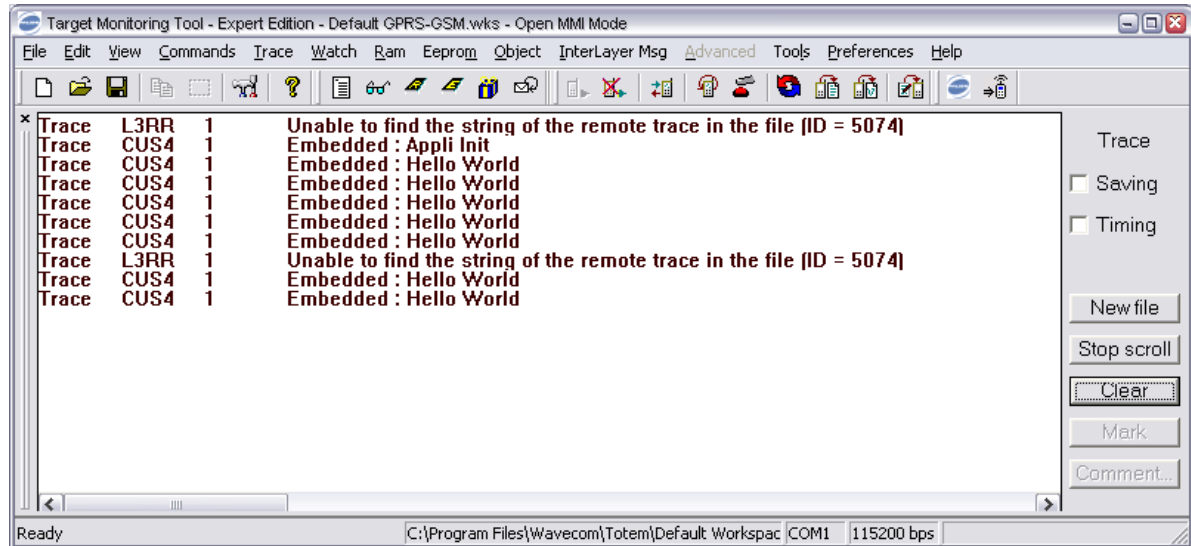
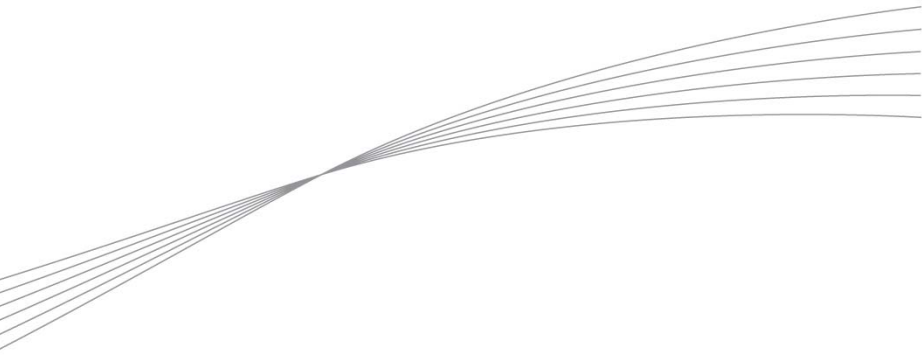


Figure 42 : Embedded application traces



**wavecom**   
*Make it wireless*

---

WAVECOM S.A. - 3 esplanade du Foncet - 92442 Issy-les-Moulineaux Cedex - France - Tel: +33(0)1 46 29 08 00 - Fax: +33(0)1 46 29 08 08  
Wavecom, Inc. - 4810 Eastgate Mall - Second Floor - San Diego, CA 92121 - USA - Tel: +1 858 362 0101 - Fax: +1 858 558 5485  
WAVECOM Asia Pacific Ltd. - 4/F, Shui On Centre - 6/8 Harbour Road - Hong Kong - Tel: +852 2824 0254 - Fax: +852 2824 025

[www.wavecom.com](http://www.wavecom.com)