

# Bluetooth Development Kits

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## ABSTRACT

Development kits are easiest way to start prototyping new technologies like Bluetooth. This article gives some information, which helps choosing development kit. Also some alternatives found from the Internet are listed and picked out.

## Keywords

Bluetooth, devkit, development kit, microcontroller, UART, i2c, RS232, USB

## 1. INTRODUCTION

Bluetooth technology will enable users to connect a wide range of computing and telecommunications devices easily and simply, without the need to buy, carry, or connect cables. [0] To make this true, technology must first be implemented into hardware. Using a development kit is the first step of implementing this technology and this article will go through several development kit alternatives found from the Internet.

Development kits can be connected to PC or they can be interfaced with real hardware solutions by using microcontrollers. I'll give a brief description of terms that is good to know when choosing development kits.

### 1.1 Microcontroller

Microcontroller is a highly integrated chip that contains all the components comprising a controller. Typically this includes a CPU, RAM, some form of ROM, I/O ports, timers and UARTs. Unlike a general-purpose computer, which also includes all of these components, a microcontroller is designed for a very specific task -- to control a particular system. As a result, the parts can be simplified and reduced, which cuts down on production costs. [13]

Microcontrollers cost usually \$1 - \$10 and they have either hardware or software UARTs, which makes it rather easy to interface with bluetooth development kits.

### 1.2 UART

UART (*universal asynchronous receiver-transmitter*) is a component that handles asynchronous serial communication. UART chip uses TTL signal levels, 0V presenting logical 0, 5V presenting logical 1.

Microcontrollers can have built-in UART or they can emulate UART with software.

### 1.3 RS232(C)

RS232C is an interface approved by the Electronic Industries Association (EIA) for connecting serial devices [14].

RS232 is well known from PC's communication ports. Actually it's almost the same thing as UART but signal levels are -12V (logical 0) and +12V (logical 1). UARTs can communicate with each other directly with TTL signals or by using RS232's signal levels. Development kits have usually both UART and RS232 connectors for easy interfacing either with PC's serial (RS232) or directly with another UART or microcontroller with software emulated UART.

### 1.4 USB

Short for Universal Serial Bus, a new external bus standard that supports data transfer rates of 12 Mbps (12 million bits per second). A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards. USB also supports Plug-and-Play installation and hot plugging. [17]

## 1.5 I2c

Short for **Inter-IC**, a type of bus designed by Philips Semiconductors in the early 1980s, which is used to connect integrated circuits (ICs) [15]. I2c is very widely used bus connecting memories, displays, UARTs and other components into microcontroller hardware. I2c can also be found from some BT development kits.

## 2. BLUETOOTH DEVELOPMENT KITS

Development kits are circuit boards with all electronics needed to implement a bluetooth device. It usually means:

- Circuit board
- Power supply
- Bluetooth core chip
- Bluetooth RF (radio) module
- Interface (USB, UART+RS232, maybe i2c for interfacing with microcontroller)
- PCM chip and audio interface for audio applications
- Connector for external antenna

### 2.1 Interfacing bluetooth kit with PC

There are two ways to use bluetooth development kit under PC's command: USB or RS232 serial communication. Many development kits come with drivers and samples that make implementing bluetooth applications rather easy.

If audio features are used, development kit is connected to PC's audio card or directly to microphone and speakers.

It could be wise to always start development with a PC even if hardware solution is a target because debugging a PC software is much easier than debugging a software which lays in a memory of microcontroller!

### 2.2 Interfacing with microcontroller

RS232/UART is the first alternative to connect development kit with microcontroller hardware because almost all microcontrollers has support for serial communication. It must be noticed that RTS/CTS handshake should be used, otherwise you will likely drop characters. When communicating with BT development kit it is not possible to recover after a lost character. The serial communication has to be absolutely safe [7].

USB has become available lately, for example Microchip has some support for PIC microcontrollers [2].

Some development kits have support for i2c communication, which is very widely used protocol for microcontrollers [3].

## 3. Development kit alternatives

I found some development kits from the Internet. Following information is gathered from the documents provided by authors and dealers. Notice that if you want to implement something useful you need usually two kits; price (if known) is for one unit!

Product	Price	Interfaces	PC software
Ericsson, Bluetooth starter kit [4]	\$3000	RS232/UART, USB, i2c, audio	Applications demonstrating how to implement data transfer and voice communication
Ericsson, Bluetooth development kit [5]	>\$5000	RS232/UART, USB, i2c, audio Additional interfaces for low level hardware debugging	Applications demonstrating how to implement data transfer and voice communication
Sigma, application tool kit	\$1200  Universities: \$500 / pcs	RS232/UART and USB.  No direct support for voice applications (needs external PCM)	Sample chat app, both executable and source
Stonestreet One Developer's kit [8]	\$2500	RS232/UART, USB, i2c, audio	ANSI C application showing how to connect between devices and send/receive data
BlueCore development kit [9]	\$9000	RS232, USB, audio	Drivers and samples
Codico, BDK2 Bluetooth Development Kit [10]	N/A	RS232, USB, PC-card	SDK not included but available
Oki Bluetooth System Development Kit [11]	N/A	RS232, USB, audio	N/A
WidComm Bluetooth Developer Kit [12]	N/A	RS232, usb	Interface test programs, sample applications
Nokia Bluetooth Kit [16]	Includes 2 PC cards  Price published 4Q2000,	PCMCIA	Windows drivers, sample applications. Version 1.0 not fully bluetooth compatible!

I found that most interesting ones are: Ericsson Bluetooth Starter Kit, Sigma and Nokia Bluetooth kit.

### 3.1 Ericsson Bluetooth Starter Kit

This development kit seems to have everything in it. Differences to Ericsson BT Development kit are very small (Development Kit has some low level monitoring and debugging support – something that most programmers and implementers doesn't want to deal with!). If you are looking for voice applications this seems to be easiest alternative



Picture 1. Ericsson Bluetooth Starter Kit

### 3.2 Sigma

Sigma uses Ericsson bluetooth chip set and it's actually designed by Ericsson.

Compared to Ericsson starter kit, voice option is missing (Though, it is possible to access the PCM pins of the Bluetooth module, thereby achieving the hardware possibilities for sending voice if there is an external PCM-CODEC system attached [7]).

Price is cheapest of alternatives so you should go for this if voice application is not the first thing you are aiming!



Picture 2. Sigma Bluetooth kit

### 3.3 Nokia Bluetooth Kit

According to specifications this will be easiest way to start with. On the other side you can't implement this into hardware – it's a PC card!



Picture 3. Two laptops communicating with Nokia Bluetooth kit!

## 4. CONCLUSIONS AND FURTHER WORK

BT Development kits are very expensive; costs are \$1000 - \$8000 / pcs. It's very much for a chip that is targeted to cost less than \$10!

Usually this kind of development kits (for other technologies) costs \$100-\$300.

It's very likely that in a near future the prices will go rapidly down when chips are been mass-produced.

If you want to start playing with these technologies, you should first choose if you needed voice features or not. Simpler kits like Sigma are cheaper but they provide everything you need to make data communication applications.

If voice is needed you have to choose between Ericsson, Stonestreet or BlueCore.

Another thing is that these kits maybe very hard to get even if you have money – Time of delivery can be very long!

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