FEATURES

- Bluetooth V1.2 board
- Serial interface on DB9 connector
- USB connection
- PCB antenna on board
- Single 5 V supply voltage
- CE compliant
- FCC compliant
  FCC ID: S9N16C2

DESCRIPTION

GSBT2416C2DB.xxx is a Bluetooth Class2 Demoboard for GSBT2416C2 Bluetooth module including the RF antenna.
Suffix **xxx** identify the Firmware release **: no suffix** for **HCI** commands and **AT1** for **AT** commands**.**

GSBT2416C2DB. is a board with a downloaded FW which enables the user to to interface the Bluetooth module with HCI commands.

GSBT2416C2DB.AT1 is a board with a downloaded FW which enables the user to create a Bluetooth link with simple AT commands.
AT commands are sent by means the serial line which is accessible by the DB9 connector.

SPBT2425C2DB.xxx board can be supplied by an external 5V DC source or via the USB port

1 - RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VDD	Board Supply voltage	-20°C < T < 70°C	4	5	6	V
Tstg	Operating ambient temperature		-20		+70	°C

2 - I/O CONNECTIONS

		DESCRIPTION	
J1	1	Boot signal - If connected to GND the module can perform the dowloading – see also JP1	
	2	Reset signal - A low level on this pin force the module in reset state - see also S3	
J2		USB Port When the USB port is connected , the 5V USB is used (by the 3.3V regulator) to supply the BT module and the board itself **When USB port is used do not supply an ext. 5V to J4 power plug** *USB port is not used for AT version*	
J3		Serial line port (DB9 male connector) On board is present a level translator to adapt the BT module digital levels to the RS232 standard levels.	
J4		Vcc Power supply plug (5V) **When 5v input is used on J4 plug do not connect USB port**	
J5	1	GPIO 15	
	2	GPIO 14	
	3	GPIO 13	
	4	GPIO 12	
	5	GPIO 11	
	6	GPIO 10	
	7	GPIO 9	
	8	GPIO 8	
	9	GPIO 7	
	10	GPIO 4	
	11	GPIO 3	
	12	GPIO 2	
	13	GPIO 0	
JP1		Boot If connected to GND the module can perform the dowloading	
JP2		DB9 connector connection – see electrical drawing	
JP3		DB9 connector connection – see electrical drawing	
JP4		DB9 connector connection – see electrical drawing	
JP5		DB9 connector connection – see electrical drawing	
JP6		DB9 connector connection – see electrical drawing	
S1		N.O. push button connected to BT module GPIO6; when activated a Low level is applied to GPIO6 otherwise GPIO6 is at High level. *Not used for AT commands version*	
S2		Switch connected to GPIO3 (10 KΩ pullup to 3.3V) *In AT version this switch is used to select Command / Data mode*	
S3		Reset – Push button acting on the module reset pin	
L1		LED connected to BT module GPIO1 . *On AT version this led shows when a Bluetooth connection is ON (led ON)*	
L2		LED showing the presence of the 3.3V internal voltage – Bluetooth module supply voltage	

3 - BOARD LAYOUT
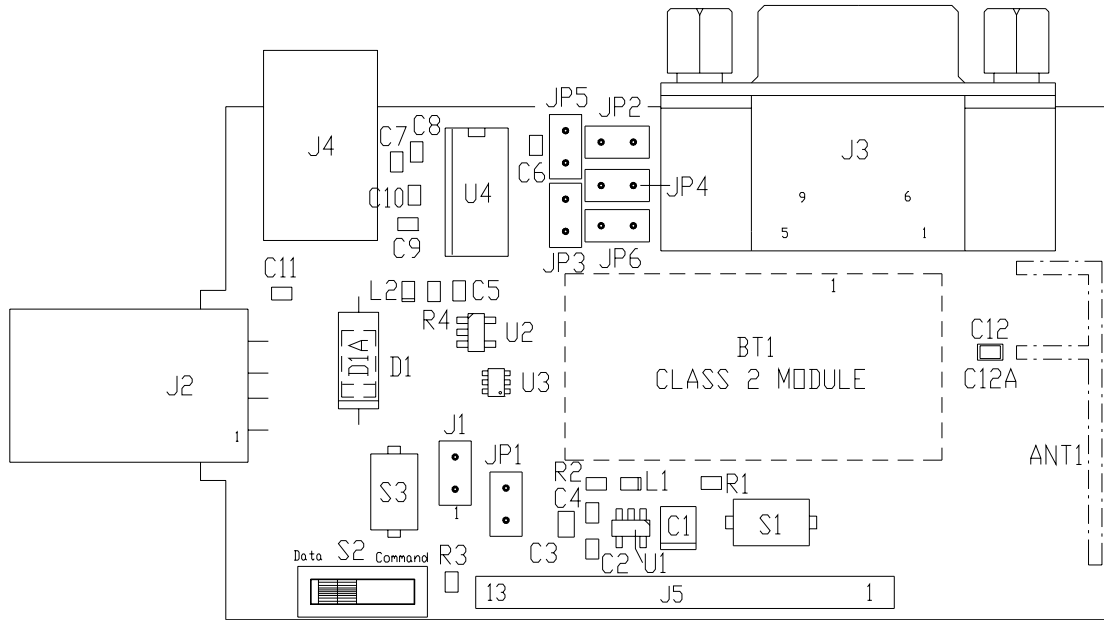
4 - ELECTRICAL DRAWING
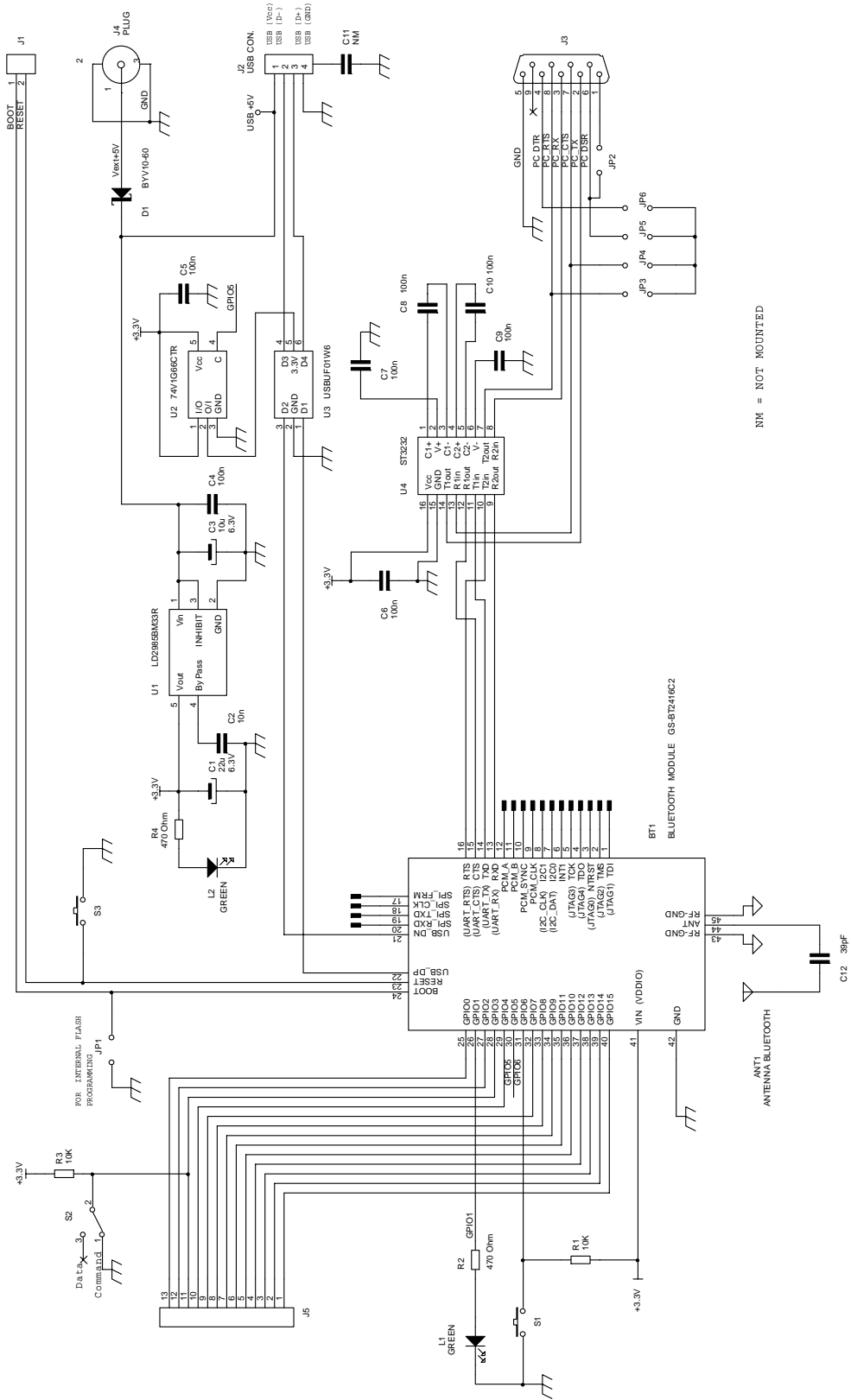
NM = NOT MOUNTED

5 - DOWNLOADING

GSBT2416C2DB.xxx has also the possibility to be downloaded with a file developed by the user

To download a file into GSBT2416C2DB the below items must be followed:

- connect the board to a PC by means a RS232 cable connected on COM1 / COM2
- put a jumper on JP1 (Boot pin to low level)
- connect the power supply cable to the board at +5V ext Vin
- open the "Flash loader " program
- choose UART on Transportation layer section
- choose the appropriate COM1 / COM2 port
- choose the firmware to be downloaded on "Firmware " section

- press start : on the dialog bar will appear " reset the board"
- power the board   (a reset is generated) : on the dialog bar will appear the % of the downloading.

6 - CERTIFICATIONS

6.1 - CE

Measurements have been performed in accordance with (report available on request):

EN 300 328 V 1.6.1 (2004-11) : " Electromagnetic compatibility and radio spectrum Matters (ERM); Wideband Transmission Systems; Data transmission equipment operating in the 2.4GHZ ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE directive"

EN 301 489-17 V 1.2.1 :2002: " Electromagnetic compatibility and radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services ; Part 17: Specific condition for 2.4GHz wideband transmission systems and 5 GHz High performance RLAN equipment."

**EN 60950-1 :** "Information technology equipment -Safety –Part 1 : General requirements "

6.2 - FCC

To get compliance with FCC CFR47 part15 the following tests have been performed:

CFR47 part 15 section	Title	Result
15.203 15.247 (b) (4) (i)	Antenna requirements	pass
15.247 (a)	Conducted emission	pass
15.209 (a) (f)	Radiated emission	pass
15.247 (a)	Frequency hopping –Spread Spectrum Spec	pass
15.247 (b)	Maximum Peak Output power	pass
15.247 (d)	100 kHz Bandwidth of Frequency Band Edges	pass
15.247 (d)	Conducted emission	pass
15.247 (e)	Power Spectral density	pass
15.247 (g)	FHSS transmission characteristics	pass
15.247 (i) (§47CFR1.1307 (b)(1))	RF Humane exposure	pass

This board has the following FCC ID:

FCC ID:S9N16C2
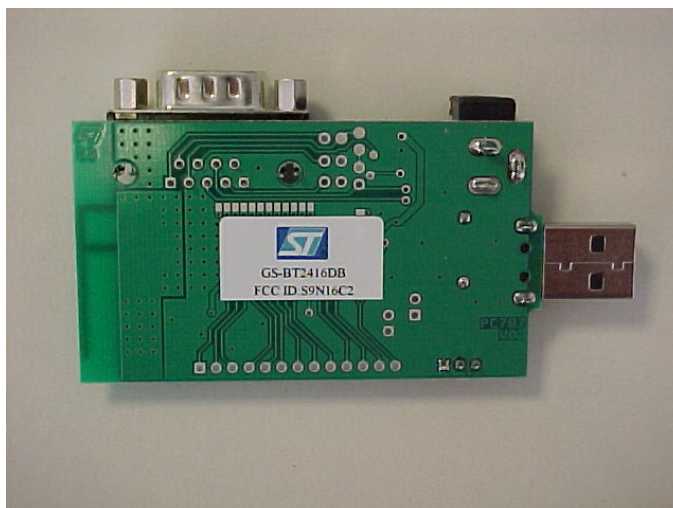
FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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.

Antenna

Our board type GS-BT2416C2DB.xxx is for OEM integrations only. The end-user product will be professionally installed in such a manner that only the authorized antennas are used.

Caution

Any changes or modifications not expressed approved by the party responsible for compliance could cause the module to cease to comply with FCC rules part 15, and thus void the user's authority to operate the equipment.

Label instruction

Module type   : Bluetooth class 2 board   *GSBT2416C2DB.xxx (GSBT2416C2 module + PC 787 carrier board)*

FCC-ID   : S9N16C2

This intends to inform you how to specify the FCC ID of our Bluetooth board GSBT2416C2DB.xxx on your final product.

Based on the Public Notice from FCC, the product into which the our transmitter module is installed must display a label referring to the enclosed module.
The label should use wording such as "Contains Transmitter module FCC ID: S9N16C2 or "Contains FCC ID: S9N16C2, any similar wording that expressed the same meaning may be use.

It shows an example below

Contains FCC ID: S9N16C2

Special requirement for Modular application

The following requirements are fulfilled:

1) The modular transmitter must have its own RF shielding:

The RF module fulfils the emission requirements of the FCC rules without additional shielding.

2) The modular transmitter must have buffered modulation/data inputs:

The module has a memory management unit inside of the IC. The processor interfacing with the external application by means general purpose I/O (GPIO) , Uart, USB, PCM, I2C, SPI. The processor interfaces also the RF part of the module exchanging data and commend with it. Inside the processor a flash memory is available to download the customer application and the Bluetooth profiles.

3) The modular transmitter must have its own power supply regulation:

The module contains an own voltage regulation. In case of changes in the supply voltage VCC (for example caused by temperature changes or other effects), the internal voltage will be stabilized.

4) The modular transmitter must comply with the antenna requirements of Section 15.203 and 15.204:

The RF module is for OEM (Original Equipment Manufacturer) integration only. The end-user product will be professionally installed in such a manner that only the authorized antenna is used.

5) The modular transmitter must be tested in a stand-alone configuration:

The RF module was tested in a stand-alone configuration.

6) The modular transmitter must be labelled with its own FCC ID number:

The RF module will be labelled with its own FCC ID number. When the module is installed inside the end-product, the label is not visible. The OEM manufacturer is instructed how to apply the exterior label.

7) The modular transmitter must comply with any specific rule or operating requirements applicable to the transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements:

The EUT is compliant with all applicable FCC rules. Detail instructions are given in the product Users Guide.

8) The modular transmitter must comply with any applicable RF exposure requirements.
   - Maximum measured power output: 1,08 mW (0,33 dBm)
   - Maximum antenna gain: 1 dBi = numeric gain 1,259   (see also FCC test report)

Maximum permissible exposure defined in 47 CFR 1.1310: 1 mW/cm².

The RF module operates at low power level so it does not exceed the Commission's RF exposure guidelines limits; furthermore, Spread spectrum transmitters operate according to the Section 15.247 are categorically excluded from routine environmental evaluation.

7 - AT COMMANDS APPENDIX

This section is applicable to demoboard with AT command FW downloaded (GSBT2416C2DB.AT1)
Purpose of this section is to describe all the necessary steps to establish a connection between two Bluetooth
GS-BT2416C2DB.AT1 demo boards in a Serial line /Cable replacement application.
(*This connection example is also reported on OBSTFW-101 datasheet, Application Notes (vers 1.6))*

SETUP & CONNECT

To perform the connection you need two PC and two GS-BT2416C2DB.AT1 boards.
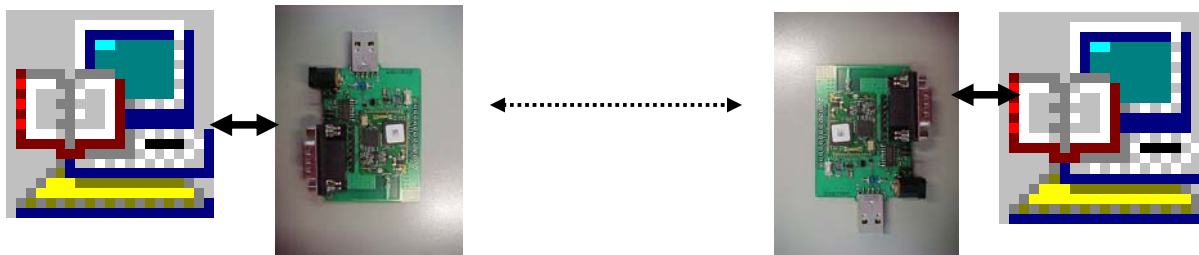
Steps to connect.
(please refer to OBSTFW-101v 1.2.1.8 datasheet for the meaning of AT commands)

- **Fix** a GS-BT2416C2DB.AT1 board to be used as "Client" and suppose it has the address 0080E1000001.
  Hereafter this board will be called "Client"

- **Fix** a GS-BT2416C2DB.AT1 board to be used as "Server" and suppose it has the address 0080E1000002.
  Hereafter this board will be called "Server"

- **Connect** the Server board to a PC by means a RS232 cable

- **Connect** the Client board to a PC by means a RS232 cable

- **Open** on both the PCs HyperTerminal program and set the communication line with the following parameters:
    o Select the proper COM line (COM1, COM2......)
    o baud rate : 9600 (default baud rate of GSBT2416C1/AT module)
    o data bits: 8
    o parity : none
    o stop bits : 1
    o flow control : none
    o In ASCII setup ,set flag line ends with line feed
    o In ASCII setup , set flag echo characters typed locally

- **Power** with the external 5V the Client board : on the PC screen connected to the Client should appear +READY

- **Power** with the external 5V the Server board : on the PC screen connected to the Server should appear +READY

- **Configure** the Client board by means the following commands:
        (*GPIO3 Client must be Low to select Command Mode – S2 switch in Command mode*)

Command	Answer	
AT	OK	Check module ready
AT+BTCMODE=0	OK	
AT+BTPMODE=1	OK	
AT+BTDMODE=0	OK	Not Discoverable
AT+BTSECMODE=1	OK	
AT+BTENCMODE=0	OK	
AT+BTNAME="SPP Client"	OK	Set client name
AT+BTCLASS=52020C	OK	

- **Configure** the Server board by means the following commands:
  (*GPIO3 Server must be Low to select Command Mode*– S2 switch in Command mode)

Command	Answer	
AT	OK	Check module ready
AT+BTCMODE=1	OK	
AT+BTPMODE=1	OK	
AT+BTDMODE=1	OK	Discoverable
AT+BTSECMODE=1	OK	
AT+BTENCMODE=0	OK	
AT+BTPINCODE="1234"	OK	Pin code
AT+BTNAME="SPP Server"	OK	Set server name
AT+BTCLASS=52020C	OK	
AT+BTREGPORT="SPP port"	OK	Name of service offered

After the Server board configuration , Server board GPIO3 must be put HIGH to select DATA MODE   enabling the Server board to receive and transmit DATA.

- **Inquiry & available Services**

Before to establish a connection, the Client has to know which Bluetooth devices are present and which services are offered, and therefore the Client:

- will perform first the inquiry by the command:

  AT+BTINQ=xx   where xx is the inquiry time (i.e. 10 sec -> AT+BTINQ=10)
   The answer will be a list of present Bluetooth connectable devices, one of the device should   be our SPP Server:

  +BTINQRES:0080E1000002,"SPP Server"
  OK

 - and after will ask for which kind of service is available with the command:
   AT+BTRPORTS=0080E1000002

  The answer will be :
   +BTRPORT:"SPP Port",1   serial port profile , port 1 (can be 1,2…)
   OK

- **Once known** the device present, the service offered, the Client finalize the connection with the command :

AT+BTCONNECT=0080E1000002,1,"1234",1,0
OK

At this point the connection is established and GPIO1 (indicating the connection status) on both Client and Server boards becomes high.
On the GS-BT2416C1AT1 board a led is connected to GPIO1 and therefore the connection is shown also by a led on.

GPIO3 on Client board must be now put at HIGH level allowing the Client to send and receive DATA from Server.

- **Disconnection**

To disconnect, the Client has to put its GPIO3 LOW (Command mode) (the changing from high to low on GPIO3 is signaled on the Client PC screen with +READY) and send the command :

AT+BTDISCONNECT
OK

The result will be the disconnection of the link Client / Server and GPIO1 on both Client and Server boards will return to low (the leds will go off).

MACRO INSTRUCTIONS

With the version 1.2.1.8 of OBSTFW -101 has been introduced the MACRO concept with the commands AT+BTMACROSTART , AT+BTMACROSTOP and AT+MACROCLEAR.

These commands work in such a way that all the commands written between AT+BTMACROSTART and AT+BTMACROSTOP commands will be stored inside the internal flash memory and executed at each power up of the module.
Take note that when you insert a command between MACROSTART and MACROSTOP you have not the immediate execution of the command but only the storing in the flash memory, the module will answer with OK or ERROR from a syntax point of view.; execution will be active at the next power on.

That means, after the writing of the commands between the two macro commands, the module could work in a stand alone way without the need to program it at each power on.

MACROCLEAR command will erase all the commands stored.

As an example: suppose to have always the previous modules with final address 01 (client) and 02 (server) and to know already which connection to get .
Write the following sequence of commands in client and server module , after the MACROSTOP command it will be stored into the internal memory of the correspondent module .

Client	Server
AT+BTMACROSTART	AT+BTMACROSTART
AT+BTCMODE=0	AT+BTCMODE=1
AT+BTPMODE=1	AT+BTPMODE=1
AT+BTDMODE=0	AT+BTDMODE=1
AT+BTSECMODE=1	AT+BTSECMODE=1
AT+BTENCMODE=0	AT+BTENCMODE=0
AT+BTNAME="SPP Client"	AT+BTPINCODE="1234"
AT+BTCLASS=52020C	AT+BTNAME="SPP Server"
AT+BTCONNECT=0080E1000002,1,"1234",10,5	AT+BTCLASS=52020C
AT+BTMACROSTOP	AT+BTREGPORT="SPP port"
	AT+BTMACROSTOP

Note that :
- As the address module to connect is know , the inquiry command can be omitted
- In BTCONNECT command has been set 10 retry at 5 sec interval.

After the modules have been programmed, you can power off and power on again the modules themselves; you will see that at a certain point the modules will be connected each other (led on) without any intervention .
Is not important to power on before the server or the client ; the only rule to follow is ,once the client has been powered on, getting the server powered in the time fixed by the 10 retry at 5 sec interval.

During the macro execution the module will answer with "OK or "ERROR" for each command executed; if this feedback is not wished ,it can be avoided with the AT+ECHO=OFF command.

MODULE BT ADDRESS

Each module has its own address which identify the module itself in the network; for the above examples have been always taken in consideration addresses 0080E1000001 and 0080E1000002.
Modules on GS-BT2416C1AT1 board could have different addresses ; before to start sending commands, the module address can be found with the command AT+BTSETTINGS=? which will show the relevant information of the module including the BT address.

POINT to POINT CONNECTION

Modules with AT commands firmware can only perform point to point connection which means only a connection per time can be activated.
A module can be connected with several other modules but it has to disconnect the previous connection before to activate a new one.

Suppose to have a Client C1 which need to connect with Server S1,S2,..Sn :
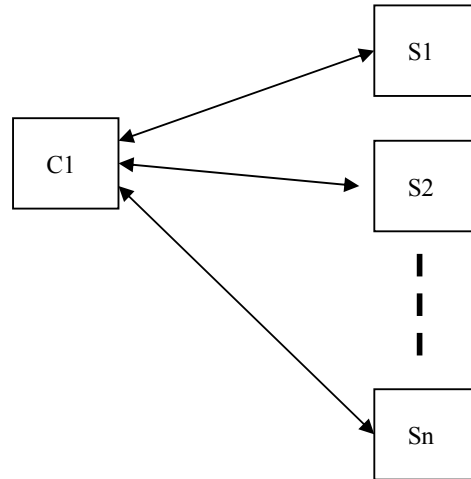
In this case the procedure to follow is the following :

- C1 will establish the connection with S1 exchanging the data
- C1 will disconnect S1 with the command AT+BTDISCONNECT
- C1 will establish the connection with S2 exchanging the data
- C1 will disconnect S2 with the command AT+BTDISCONNECT
- C1 will establish the connection with Sn exchanging the data… an so on

GSBT2416C2DB.xxx