BTM-5 Bluetooth

Wireless TTL Master/Slave Transceiver Module

Datasheet

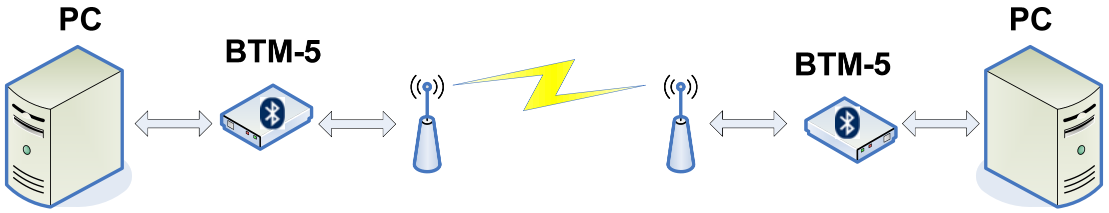
Rev 2.0, Jan 2011

Content

1. Key Features

- Bluetooth Spec v2.0+EDR Compliant
- Class 2 type Output Power
- Full speed Bluetooth operation with full piconet support
- Scatternet support
- Support Serial Port Profile (SPP)
- Onboard antenna
- 3.3V operation
- UART interface
- Support for 8Mbit external onboard Flash
- Minimized size 26.9mm(L) x 13mm(W) x 2.2mm(H)
- RoHS Compliant

2. Product Description



BTM-5 module is a Class 2 Bluetooth module using BlueCore4-External chipset from leading Bluetooth chipset supplier Cambridge Silicon Radio. This module both support Master and Slave mode operation, it can be easily changed by AT command configuration. Each Master/Slave BTM-5 pair auto link with the default device address after power up. After link is established, user can transmit and receive data via the UART interface with each other. The transmission is almost transparent to user, it acts as tow UART connect with each other wirelessly.

It is highly recommend to use BTM-5 pair to communicate with each other. User can also use the module with the Laptop, PDA, Mobile Phone and etc.

3. Applications

- Bluetooth Carkit
- PCs
- Personal Digital Assistants (PDAs)
- Computer Accessories (Compact Flash Cards, PCMCIA Cards, SD Cards and USB Dongles)
- Access Points
- Digital Cameras

4. Specifications

Parameters	Specifications
Operating Frequency Baud	2.4GHz-2.48GHz unlicensed ISM Band
Bluetooth Specification	V2.0+EDR
Output Power Class	-4 ~ 6dBm adjustable , Class 2
Sensitivity	-80dBm at 0.1% BER
Data Rate	Asynchronous: 2Mbps (Max)
Operating Voltage	3.3V
Host Interface	USB / UART
Audio Interface	PCM and Analog interface
Flash Memory Size	8Mbit
Operation temperature	-20 ~ +55 ℃
Dimension	26.9mm(L) x 13mm(W) x 2.2mm(H)

*Specifications are subject to change without prior notice

5. Electrical Characteristics

Absolute Maximum Ratings		
Rating Min		Max
Storage temperature	-40℃ +150	℃
Supply voltage : VBAT	-0.4V	5.6V
Other terminal voltages	VSS-0.4V	VDD+0.4V

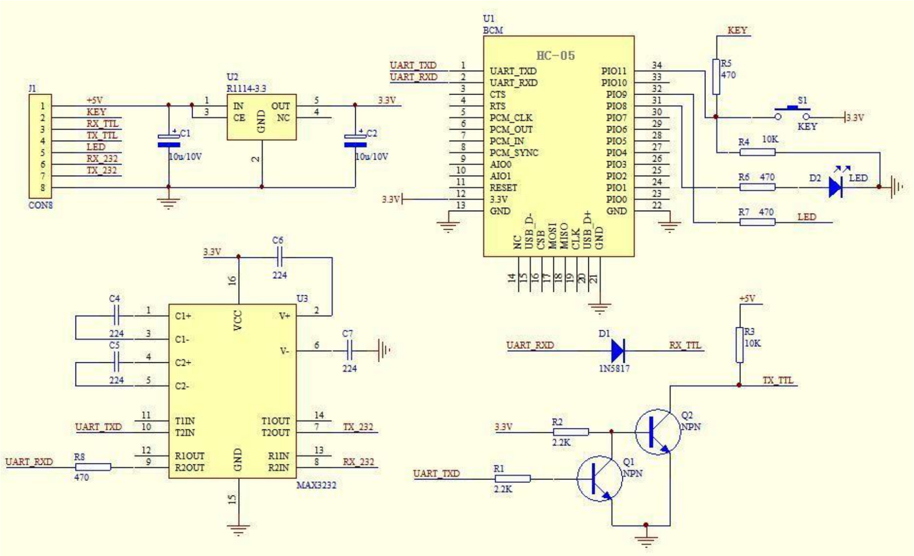
Recommended Operating Conditions		
Operating Condition	Min	Max
Operating temperature range	-40℃ +150	℃
Guaranteed RF performance range	-25℃ +75	℃
Supply voltage : VBAT	2.2V	4.2V

6. Power Consumption

Operation Mode	Connection Type	UART Rate (kbps)	Average	Unit
Page scan	-	115.2	0.42	mA
ACL No traffic	Master	115.2	4.60	mA
ACL with file transfer	Master	115.2	10.3	mA
ACL 1.28s sniff	Master	38.4	0.37	mA
ACL 1.28s sniff	Slave	38.4	0.42	mA
SCO HV3 30ms sniff	Master	38.4	19.8	mA
SCO HV3 30ms sniff	Slave	38.4	19.0	mA
Standby Host connecton	-	38.4	40	uA

7. Typical Application

The following schematic is the typical hardware application for the BTM-5 module, it provide both RS232 and 5V TTL logic level connection to the module.



We provide two variations of BTM-5 breakout board, one is RS232 interface, the other is TTL interface. Note that these two different breakout board use different supply voltage and different interface, please take care before using them.

RS232 Bluetooth Module + Shield

TTL Bluetooth Module + Shield

Pins	Signals	RS232 breakout board	TTL breakout board
1	VCC	5V power suppler	3.3V power suppler
2	Mode	1=AT cmd mode, 0=Normal	1=AT cmd mode, 0=Normal
3	RX	RS232 logic level	
4	TX	RS232 logic level	3.3V logic level
5	GND	Power ground	Power ground

User can change the default setting of BTM-5 module with the AT command via onboard button or ‘Mode’ pin. If the bottom pressed or ‘Mode’ pin pulled high, the module enter the AT command mode. The breakout board provide two LED to indicate the status of the module, the RED led indicate the link activity status, the GREEN led indicate the pairing status.

8. Basic AT Command

Users can use AT commands to setup the module with different configurations. Every AT command must be followed with <CR> and<LF> control character which is 0x0D and 0x0A in hexadecimal. Every AT command will followed with a response "OK". They will be some basic AT command you should know.

1. AT

AT command is use to test the module to see if it is OK.

2. AT+RESET

AT+RESET command is reset the module back to power up status.

3. AT+ROLE?

AT+ROLE? command inquiry the module's role, 0 = Slave, 1 = Master, 2 = Slave-loopback.

4. AT+ROLE=<param>

AT+ROLE command is used to set the module with master or slave, 0 = Slave, 1 = Master, 2 = Slave-loopback. You have to configure one module to master and the other to slave to become a pair.

5. AT+CMODE?

AT+CMODE? command inquiry the link mode. 0 = Specific bluetooth link address, 1 = Any bluetooth link address, 2 = Slave-loopback

6. **AT+CMODE=<param>**

AT+CMODE command is used to set up module link mode. 0 = Specific bluetooth link address, 1 = Any bluetooth link address, 2 = Slave-loopback. It is better to set the mode to 1 if you only have one pair device, because it is much easier to make them a pair.

7. AT+PSWD?

AT+PSWD? command inquiry the password of the module.

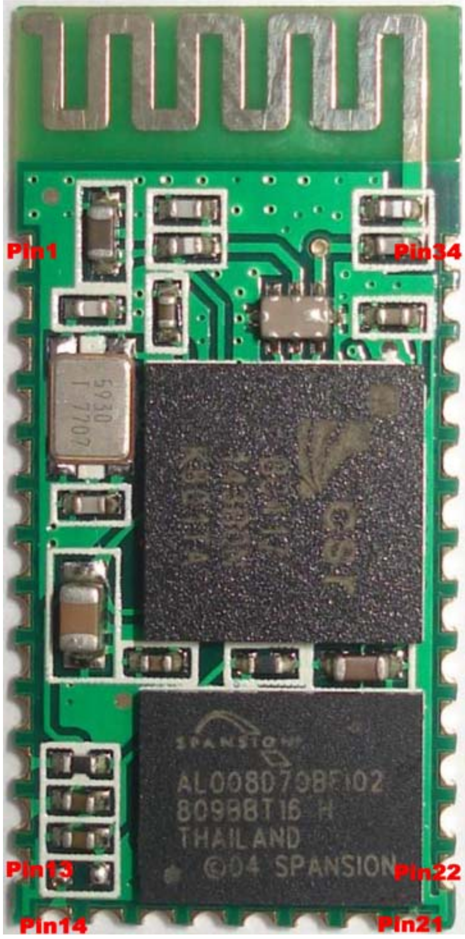
8. AT+PSWD=<param>

AT+PSWD command is used to set the pairing password.

9. AT+UART?

AT+UART? command inquiry the uart configurations

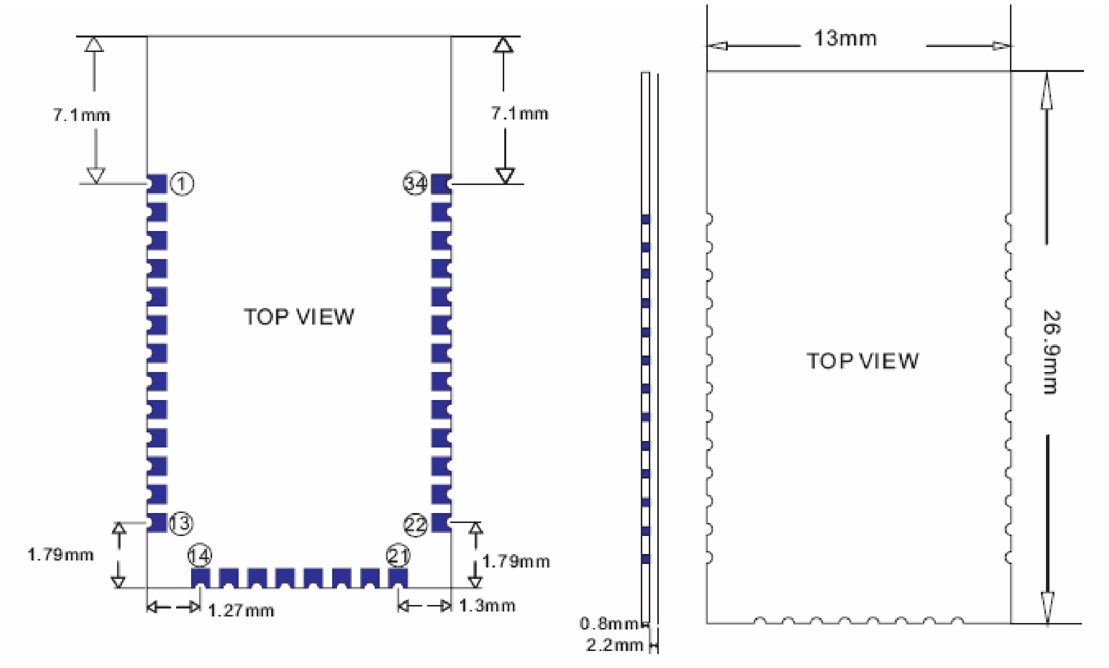
9. Pin Definition

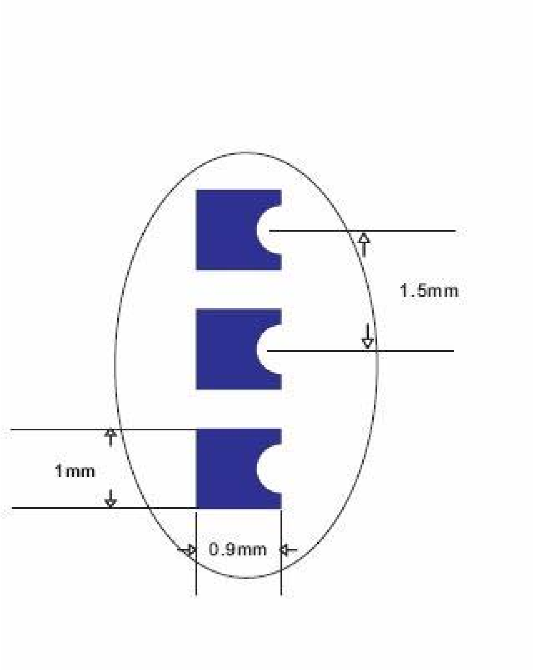


Pin	Description
1 UAR	T_TXD
2 UAR	T_RXD
3 UAR	T_CTS
4 UAR	T_RTS
9~11 N	A
12	3.3V Supply input
13 GND	
14~20 N	A
21,22 G	ND
23	PIO0 Programmable IO port
24	PIO1 Programmable IO port
25	PIO2 Programmable IO port
26	PIO3 Programmable IO port
27	PIO4 Programmable IO port
28	PIO5 Programmable IO port
29	PIO6 Programmable IO port
30	PIO7 Programmable IO port
31	PIO8 Programmable IO port
32	PIO9 Programmable IO port
33	PIO10 Programmable IO port
34	PIO11 Programmable IO port

Pin Configurations

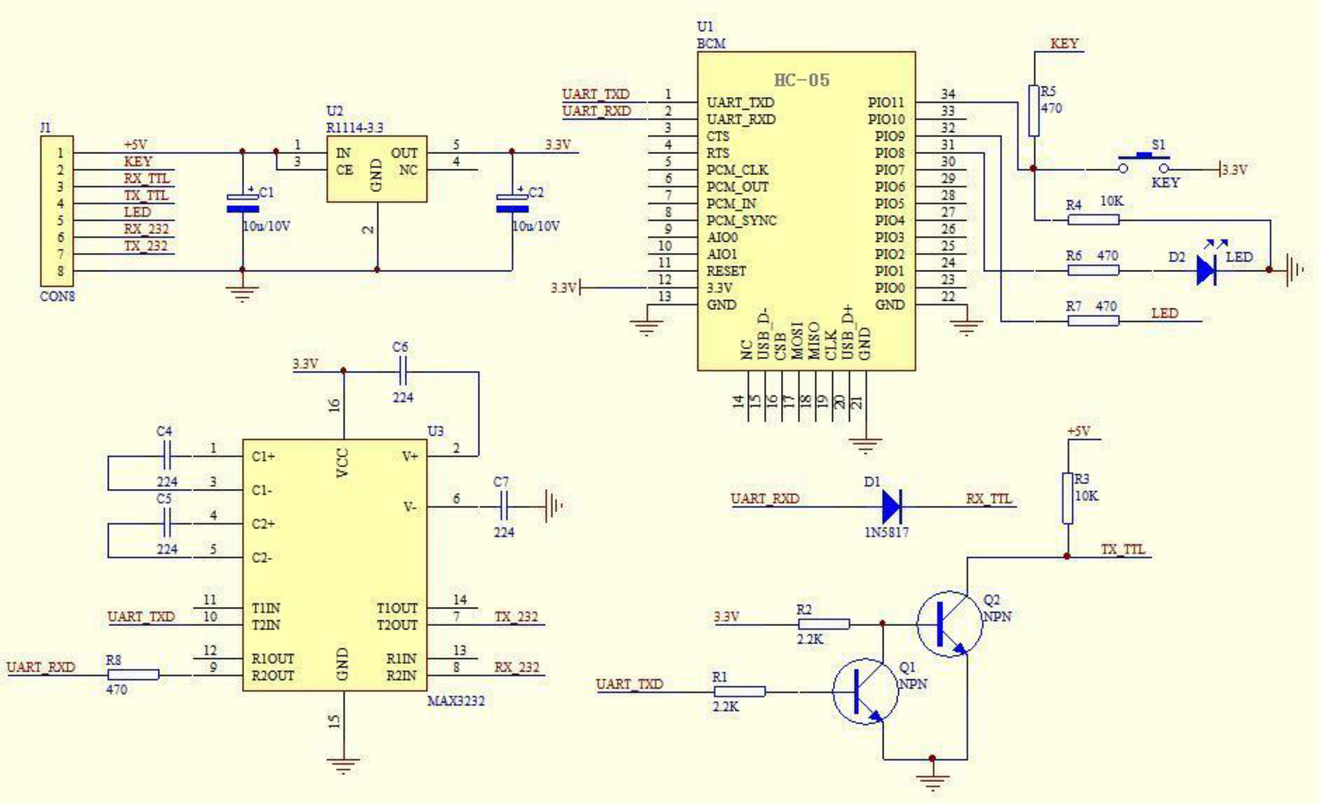
PIN NO.	NAME	TYPE	FUNCTION	RE-MARK
1	UART-TX	CMOS Output	UART Data Output	
2	UART-RX	CMOS Input	UART Data Input	
3	UART-CTS	CMOS Input	UART Clear To Send Active Low	
4	UART-RTS	CMOS Output	UART Request To Send Active Low	
5	PCM-CLK	Bi-directional	Synchronous Data Clock	
6	PCM-OUT	CMOS Output	Synchronous Data Output	
7	PCM-IN	CMOS Input	Synchronous Data Input	
8	PCM-SYNC	Bi-directional	Synchronous Data Sync	
9	AIO(0)	Bi-directional	Programmable Input/Output Line	
10	AIO(1)	Bi-directional	Programmable Input/Output Line	
11	RESETB	CMOS Input	Reset if low.Input debounced so must be low for>5ms to cause a reset	
12	3.3V	POWER	+3.3V Supply	For 3.3V Version
13	GND	GND	Ground	
14	GND	GND	Ground	
15	USB D-	Bi-directional	USB Data Minus	
16	SPI-CSB	CMOS Input	Chip Select For Synchronous Serial Interface	
17	SPI-MOSI	CMOS Input	Serial Peripheral Interface Data Input	
18	SPI-MISO	CMOS Output	Serial Peripheral Interface Data Output	
19	SPI-CLK	CMOS Input	Serial Peripheral Interface Clock	
20	USB D+	Bi-directional	USB Data Plus with selectable internal 1.5K Ω	
21	GND	GND	Ground	
22	GND	GND	Ground	
23	PIO(0)	Bi-directional with programmable strength	Control output for external LNA (if fitted)	
24	PIO(1)	Bi-directional with programmable strength	Control output for external PA (if fitted)	
25	PIO(2)	Bi-directional	Programmable Input/Output Line	
26	PIO(3)	Bi-directional	Programmable Input/Output Line	
27	PIO(4)	Bi-directional with programmable strength	Programmable Input/Output Line or optional BT_Priority/CH_Clk output for co-	
28	PIO(5)	Bi-directional with programmable strength	Programmable Input/Output Line or optional BT_Active output for co-existence	
29	PIO(6)	Bi-directional with programmable strength	Programmable Input/Output Line or optional WLAN_Active/Ch_Data input for co-	
30	PIO(7)	Bi-directional	Programmable Input/Output Line	
31	PIO(8)	Bi-directional	Programmable Input/Output Line	
32	PIO(9)	Bi-directional	Programmable Input/Output Line	
33	PIO(10)	Bi-directional	Programmable Input/Output Line	
34	PIO(11)	Bi-directional	Programmable Input/Output Line	


7.1mm
7.1mm
①
34
TOP VIEW
13
22
1.79mm
14
21
1.79mm
1.27mm
1.3mm
13mm
TOP VIEW
26.9mm
0.8mm
2.2mm


1.5mm
1mm
0.9mm

Schematic overview

The following schematic is the typical hardware application for the BTM-5 module, it provide both RS232 and 5V TTL logic level connection to the module.



The BTM-5 module pairs is default configured with 115200bps baud rate, the master and slave's PIO8 (Pin31) indicate the link status which is connected to a LED (D2) shown in the application schematic. When power up, the both module's LED flashes every 0.5 seconds and look for each other for pairing. After successfully pairing, the LED flashes 3 seconds. At this time you can transmit data via the UART port with each other.

The module's PIO11 (Pin32) is a mode selection pin to switch between normal mode and AT command mode. In the application schematic, it is connected to a button S1. When it is press down the module enter AT command mode, it come back to normal mode if the button is released. Note that, when the link is not established, once the module enter AT command mode, it will not come back to normal mode until link established or send a AT+RESET command or re-power the module.

FAQ and Known Issues

- The module is delivered with a default baud rate of 115200, although 38400baud is specified in the document.

- After sending AT+RESET, the module restores some "factory defaults" and the baud rate changes to 38400

- Changing the PIO11 level from 0 to 1 or vice-versa, when the module is powered, changes the mode of operation istantly but the LED on PIO8 blinks the same way. Thus the user does not know whether the module changed the operation mode or not. The only way to find out is trying to send AT commands and see if it responds in any way.

- When the module is powered up in Data Transfer Mode, the LED blinks quickly (2-3Hz) indicating that the module is ready to connect. After a connection has been established the LED on PIO9 lights up and the LED on PIO8 blinks short twice every second.

- When the module is powered up in AT Command Mode, the LED on PIO8 blinks slowly(1 Hz).

- REGARDLESS of PIO11 level (0 or 1) changing the BT Connection state switches the module into Data Transfer Mode. If PIO11 is 1 and the user wants to continue with the AT Command Mode after a BT connection has been establishes it has to toggle PIO11 to switch the module back in AT Command mode.

Full list of AT Commands

(AT commands can be upper or lower case, and also end with \r\n)

#1 : Test Command

Command	Return	Argument
AT	OK	NONE

#2 : Reset

Command	Return	Argument
AT+RESET	OK	NONE

Results: It works as power cycle.

#3: Poll the software version

Command	Return	Argument
AT+VERSION?	+VERSION:<Param OK	Param: software version

Example:

```
at+version?\r\n
+VERSION:1.0-20090818
OK
```

#4: Restore the default setting

Command	Return	Argument
AT+ORGL	OK	NONE

Restore the default setting:

1. Device class: 0
2. Inquiry code: 0x009e8b33
3. Device mode: Slave mode
4. Binding mode: SPP
5. Serial port: 38400 bits/s; 1 stop bit, no parity
6. Pairing code: “1234”
7. Device name: “HHW-SPP-1800-2

#5: Poll the address of the Bluetooth device

Command	Return	Argument
AT+ADDR?	+ADDR: <Param> OK	Param: the address of the Bluetooth device

Representation of the address: NAP:UAP:LAP (HEX)
Examples:
The address of the Bluetooth device is: 12:34:56:ab:cd:ef

```
At+addr?\r\n
+ADDR:1234:56:abcdef
OK
```

#6: Set and poll device name

Command	Return	Argument
AT+NAME=<Para1>	OK	Param: device name Default: “HHW-SPP-1800-2”
AT+NAME?	1: +NAME: <Param> OK --- successful 2: FAIL --- fail	

Example:

```
AT+NAME=HHW-SPP-1800-2\r\n ———— Set Device name as HHW-SPP-1800-2

OK

AT + NAME=“HHW-SPP-1800-2”\r\n ———— Set Device name as HHW-SPP-1800-2

OK

at+name?\r\n

+NAME: Beijin

OK
```

#7: Poll remote device name

Command	Return	Argument
AT+RNAME? <Param1>	1: +RNAME: <Param2 > OK --- successful 2: FAIL --- fail	Param1: remote device address Param2: remote device name

Representation of the address: NAP:UAP:LAP (HEX)
Examples:
The address of the remote Bluetooth device is: 00:02:72:od:22:24, the device name is: Bluetooth

```
t+rname? 0002,72,0d2224\r\n
+RNAMELBluetooth
OK
```

#8: Set/Poll device role

Command	Return	Argument
AT+ROLE= <Param>	OK	Param: 0 – slave 1 – Master 2 – Slave-loop Default: 0
AT+ROLE?	+ROLE: <Param > OK	

Explanation of device roles:
Slave – be connected by other device
Slave-loop – be connected by other device, receive and send back whatever received
Master – Actively poll the nearby device and initialize binding to other devices.

#9: Set and poll device type

Command	Return	Argument
AT+CLASS=<Param>	OK	Param: device type Device type is a 32-bit parameter. It is used to indicate the device class and the service it supports Default: 0 The actual meaning is explained in appendix 1.
AT+CLASS?	1. +CLASS: <Param> OK 2. FAIL	

In order the effectively filter the nearby device and quickly locate the users self defined device, user can set the device to be nonstandard device, such as 0x1f1f (hex)

#10: Set/Poll Inquire Access Code

Command	Return	Argument
AT+IAC=<Param>	1: OK 2: FAIL	Param: Inquire Access Code Default: 938b33 Detailed explanation can be found the appendix.
AT+IAC?	+IAC: <Param> OK	

If the inquire access code is set to GIAC(General Inquire Access Code: 0x9e8b33), it can be used to discover or be discovered by all nearby devices. If user wants the device to be able to be found quickly, user can set the Inquire Access Code to be code not as GIAC and LIAC, such as 0x928b3f.

Example:

```
AT+IAC=928b3f\r\n
OK
AT+IAC?\r\n
+ IAC: 928b3f
OK
```

#11: Set and poll Inquiry mode

Command	Return	Argument
AT+INQM=<Param1>, <Param2>, <Param3>	1. OK 2. FAIL	Param1: Inquiry Mode 0— inquirey mode standard 1— inquiry mode rssi Param2: max response number Param3: time out, 1-48 (1.28s-61.44s) Default: 1,1,48
AT+INQM?	+INQM: <Param1>, <Param2>,<Param3> OK	

```
AT+INQM=1,9,48\r\n   -- Set inquiry mode: with RSSI, max device response number 9 then stop inquiry, max time out 48X1.28=61.44s
OK
AT+INQM?\r\n
+INQM:1,9,48
OK
```

#12: Set and poll paring password

Command	Return	Argument
AT+PSWD=<Param>	OK	Param: paring password Default: “1234”
AT+PSWD?	+PSWD:<Param > OK	

#14: Set and poll serial port parameters

Command	Return	Argument
AT+UART=<Param1>,<Param2>, <Param3>	OK	Param1: baud rate (bits/s) 4800 9600 19200 38400 57600 115200 230400 460800 912600 1382400 Param2: stop bit 0- 1 bit 1- 2 bits Param3: parity bit 0- None 1- Odd 2- Even Default: 9600,0,0
AT+UART?	+UART:<Param1>,<Param2>,< Param3> OK	

Example: Set serial port parameters to 115200, 2 bits stop bit, and even parity

```
AT+UART=115200, 1,2 \r\n

OK

AT+UART

?

+UART:115200,1,2

OK
```

#14: Set and poll connection mode

Command	Return	Argument
AT+CMODE=<Param>	OK	Param: 0 – specific address mode (the address is specified in binding command) 2- No specific address Default: 0
AT+CMODE?	+CMODE::<Param> OK	

#15: Set and poll binding device address

Command	Return	Argument
AT+BIND=<Para1>	OK	Param – Binding Bluetooth device address Default address: 00:00:00:00:00:00
AT+BIND?	+BIND:<Param> OK	

The address can be represented as NAP:UAP:LAP (hex)
The binding command is only valid in specific address mode.

Example:

```
AT+BIND=1234,56,abcdef\r\n
OK
AT+BIND?\r\n
+BIND:1234:56:abcdef
OK
```

#16: Set/Poll the polarity of LED indicator driver

Command	Return	Argument
AT+POLAR=<Param1>, <Param2>	OK	Param1: 0 – PI08 outputs low level to turn on LED 1- PI08 outputs high level to turn on LED Param2: 0-PI09 outputs low level to turn on LED 1-PI09 outputs high level to turn on LED Default: 1,1
AT+DEFAULT		

PI08 drives the working status, and PI09 drives the link status.

Example:
PI08 outputs low level to turn on LED, and PI09 outputs high level to turn on LED.

```
AT+POLAR=0,1 \r\n
OK
AT+POLAR?\r\n
+POLAR:0,1
OK
```

#17: Set single PIO output

Command	Return	Argument
AT+PIO=<Param1>,<Param2>	OK	Param1: PIO port number (decimal) Param2L PIO port output 0- Low voltage 1- High voltage

The useable port is PIO2- PIO7 and PIO10.

Example:

1. PIO10 outputs high level
   AT+PIO=10,1\r\n
   OK
2. PIO10 outputs low level
   AT+PIO=10,0\r\n
   OK

#18: Set multiple port output

Command	Return	Argument
AT+MPIO=<Param>	OK	Param: PIO port number mask combination (hex)

The useable port is PIO2- PIO7 and PIO10.
PIO port mask = (1 << port number)
PIO port mask combination = (PIO port mask 1| PIO port mask 2 |PIO port mask 3 |...)

Example:
PIO2 mask= (1<<2)=0x004
PIO10 mask = (1<<10)=0x400
PIO port mask combination= (0x004 | 0x400)=0x404
PIO 2 and PIO 10 output high:

```
AT+MPIO=404\r\n
OK
```

#19: Poll PIO port input

Command	Return	Argument

AT+MPIO?	+MPIO: <Param>
	OK
		Param- PIO port value (16 bits)
		Param[0]=PIO0
		Param[1]=PIO1
		Paramp2]=PIO2
		...
		Param[10]=PIO10
		Param[11]=PIO11

#20:Set/Poll Inquiry parameters

Command	Return	Argument
AT+IPSCAN=<Param1>,<Param2>, <Param3>, <Param4>	OK	Param1: inquiry time interval Param2:continous poll time Param3: call time interval Param4: call continuous time All above are decimal numbers Default: 1024, 512, 1024, 512
AT+IPSCAN?	+IPSCAN:<Param1>, <Param2>,<Param3>,<Param4>	

#21:Set/Poll SNIFF energy saving parameters

Command	Return	Argument
AT+SNIFF=<Param1>,<Param2>,<Param3>,<Param4>	OK	Param1: max time Param2: min time Param3: try time Param4: time out All above are decimal numbers Default: 0,0,0,0
AT+SNIFF?	+SNIFF:<Param1>,<Param2>,<Param3>,<Param4>	

#22: Set/Poll Security and Encryption modes

Command	Return	Argument
AT+SENM=<Param1>,<Param2>	1: OK 2:FAIL	Param1: Security mode 0- Sec_mode0_off 1- Sec_mode1_non-secure 2- Sec_mode2_service 3- Sec_mode3_link 4- Sec_mod_unknown Param2:encryption mode 0- hci_enc_mode_off 1- hci_enc_mode_pt_to_pt 2- hci_enc_mode_pt_to_pt_and_bcast Default: 0,0
AT+SENM?	+SENM:<Param1>,<Param2> OK	

#23: Delete Authenticated Device from the authenticated device list

Command	Return	Argument
AT+RMSAD=<Param>	OK	Param: Bluetooth device address

Example:

Delete device with address: 12:34:56:ab:cd:ef

at+rmsad=1234:56:abcdef\r\n

OK

Or

at+rmsad=1234:56:abcdef\r\n

FAIL ==== there is no such device in the list

#24: Delete all Authenticated Devices from the authenticated device list

Command	Return	Argument
AT+RMSAD	OK	None

#25: Locate Authenticated Device from the authenticated device list

Command	Return	Argument
AT+FSAD=<Param>	1. OK - exists 2. FAIL- no-exisit	Param: Bluetooth device address

Example:
Finddevice with address: 12:34:56:ab:cd:ef
at+FSAD=1234:56:abcdef\r\n
OK

Or
at+fsad=1234:56:abcdef\r\n
FAIL ==== there is no such device in the list

#26: Obtain the total Authenticated Device number in the authenticated device list

Command	Return	Argument
AT+ADCN?=<Param>	+ADCN:<Param> OK	Param: total number of device in the authenticated device list

#27: Obtain the most recently used Authenticated Device

Command	Return	Argument
AT+MRAD?	+MRAD:<Param>	Param: most recently used authenticated device

#28: Obtain the working status of the Bluetooth device

Command	Return	Argument
AT+STATE?	+STATE:<Param> OK	Param: working status “INITIALIZED” “READY” “PAIRABLE” “PAIRD” “INQUIRING” “CONNECTING” “CONNECTED” “DISCONNECTED” “NUKNOW”

#29: Initialise the spp profile lib

Command	Return	Argument
AT+INIT	1. OK 2. FAIL	NONE

#30: Inquire nearby devices

Command	Return	Argument
AT+INQ	+INQ: <Param1>,<Param2>,<Param3> …. OK	Param1: address Param2: device class Param3: RSSI

Example 1:

```
at+init\r\n —— Initialize SPP (can't repeatedly initialize)
OK
at+iac=9e8b33\r\n ——inquire general inquire access code
OK
at+class=0\r\n —— inquire all devices types
OK
at+inqm=1,9,48\r\n —— Inquire mode: RSSI, max number 9, timeout 48
At+inq\r\n —— inquire
+INQ:2:72:D2224,3E0104,FFBC
+INQ:1234:56:0,1F1F,FFC1
+INQ:1234:56:0,1F1F,FFC0
+INQ:1234:56:0,1F1F,FFC1
+INQ:2:72:D2224,3E0104,FFAD
+INQ:1234:56:0,1F1F,FFBE
+INQ:1234:56:0,1F1F,FFC2
+INQ:1234:56:0,1F1F,FFBE
+INQ:2:72:D2224,3E0104,FFBC
OK
```

#31: Cancel Inquire nearby devices

Command	Return	Argument
AT+INQC	OK	None

#32: Device pairing

Command	Return	Argument
AT+PAIR=<Param1>,<Param2>	1. OK 2. FAIL	Param1: remote device address Param2:timeout

Example:
Pair with remote device: 12:34:56:ab:cd:ef, timeout 20 s.
At+pair=1234,56,abcdef, 20\r\n
OK

#33: Device Connection

Command	Return	Argument
AT+LINK=<Param>	1. OK 2. FAIL	Param: remote device address

Example:
Link to remote device: 12:34:56:ab:cd:ef
At+fsad=1234,56,abcdef\r\n -- check if remote device is in the authenticated device list or not
OK
At+link==1234,56,abcdef\r\n -- it is in the list, doesn't need to be inquired and can be directly linked
OK

#34: Device Disconnection

Command	Return	Argument
AT+DISC	1. +DISC: SUCCESS 2. +DISC:LINK_LOSS 3. +DISC:NO_SLC 4. +DISC:TIMEOUT 5. +DICS:ERROR	None

#35: Enter into energy saving mode

Command	Return	Argument
AT+ENSNIFF=<Param>	OK	Param: Bluetooth device address

#36: Exit energy saving mode

Command	Return	Argument
AT+EXSNIFF=<Param>	OK	Param: Bluetooth device address

Appendix 1: AT command error

ERROR code decoder

Error_code (hex)	Explanation
0	AT command error
1	The result is default value
2	PSKEY write error
3	Device name is too long (more than 32 bytes)
4	Device name is 0 byte
5	Bluetooth address: NAP is too long
6	Bluetooth address: UAP is too long
7	Bluetooth address: LAP is too long
8	PIO port mask length is 0
9	Invalid PIO port
A	Device class is 0 byte
B	Device class is too long
C	Inquire Access Code length is 0
D	Inquire Access Code is too long
E	Invalid Inquire Access Code
F	Pairing password is 0
10	Pairing password is too long (more than 16 bytes)
11	Role of module is invalid
12	Baud rate is invalid
13	Stop bit is invalid
14	Parity bit is invalid
15	No device in the pairing list
16	SPP is not initialized
17	SPP is repeatedly initialized
18	Invalid inquiry mode
19	Inquiry timeout
1A	Address is 0
1B	Invalid security mode
1C	Invalid encryption mode

Appendix 2: Device Class

The Class of Device/Service(CoD)is a 32 bits number that is made of 3 fields. One field specifies the service supported by the device. Another field specifies the major device class, which broadly corresponds to the type of the device. The third field specifies the minor device class, which describes the device type in more detail.

The Class of Device/Service (CoD) field has a variable format. The format is indicated using the 'Format Type field' within the CoD. The length of the Format Type field is variable and ends with two bits different from '11'. The version field starts at the least significant bit of the CoD and may extend upwards. In the 'format #1' of the CoD (Format Type field = 00), 11 bits are assigned as a bit-mask (multiple bits can be set) each bit corresponding to a high level generic category of service class. Currently 7 categories are defined. These are primarily of a 'public service' nature. The remaining 11 bits are used to indicate device type category and other device-specific characteristics.Any reserved but otherwise unassigned bits, such as in the Major Service Class field, should be set to 0.

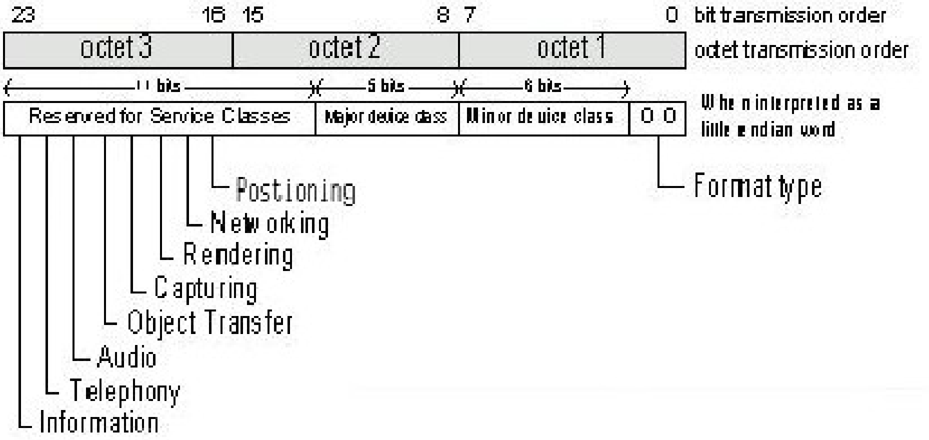


Figure 1.2: The Class of Device/Service field (first format type). Please note the order in which the octets are sent on the air and stored in memory. Bit number 0 is sent first on the air.

1. MAJOR SERVICE CLASSES

Bit no	Major Service Class
13	Limited Discoverable Mode [Ref #1]
14	(reserved)
15	(reserved)
16	Positioning (Location identification)
17	Networking (LAN, Ad hoc, ...)
18	Rendering (Printing, Speaker, ...)
19	Capturing (Scanner, Microphone, ...)
20	Object Transfer (v-Inbox, v-Folder, ...)
21	Audio (Speaker, Microphone, Headset service, ...)
22	Telephony (Cordless telephony, Modem, Headset service, ...)
23	Information (WEB-server, WAP-server, ...)

TABLE 1.2: MAJOR SERVICE

CLASSES [Ref #1 As defined in See Generic Access Profile,

Bluetooth SIG]

2. MAJOR DEVICE CLASSES

The Major Class segment is the highest level of granularity for defining a Bluetooth Device. The main function of a device is used to determine the major class grouping. There are 32 different possible major classes. The assignment of this Major Class field is defined in Table 1.3.

12	11	10	9	8	Major Device Class
0	0	0	0	0	Miscellaneous [Ref #2]
0	0	0	0	1	Computer (desktop,notebook, PDA, organizers, ...)
0	0	0	1	0	Phone (cellular, cordless, payphone, modem, ...)
0	0	0	1	1	LAN /Network Access point
0	0	1	0	0	Audio/Video (headset,speaker,stereo, video display, vcr.....
0	0	1	0	1	Peripheral (mouse, joystick, keyboards, ...)
0	0	1	1	0	Imaging (printing, scanner, camera, display, ...)
1	1	1	1	1	Uncategorized, specific device code not specified
X	X	X	X	X	All other values reserved

TABLE 1.3: MAJOR DEVICE CLASSES

[Ref #2: Used where a more specific Major Device Class code is not suited (but only as specified in this document). Devices that do not have a major class code assigned can use the all-1 code until 'classified']

3. THE MINOR DEVICE CLASS FIELD

The 'Minor Device Class field' (bits 7 to 2 in the CoD), are to be interpreted only in the context of the Major Device Class (but independent of the Service Class field). Thus the meaning of the bits may change, depending on the value of the 'Major Device Class field'. When the Minor Device Class field indicates a device class, then the primary device class should be reported, e.g. a cellular phone that can also work as a cordless handset should use 'Cellular' in the minor device class field.

4. MINOR DEVICE CLASS FIELD - COMPUTER MAJOR CLASS

7	6	5	4	3	2	Minor Device Class bit no of CoD
0	0	0	0	0	0	Uncategorized, code for device not assigned
0	0	0	0	0	1	Desktop workstation
0	0	0	0	1	0	Server-class computer
0	0	0	0	1	1	Laptop
0	0	0	1	0	0	Handheld PC/PDA (clam shell)
0	0	0	1	0	1	Palm sized PC/PDA
0	0	0	1	1	0	Wearable computer (Watch sized)
X	X	X	X	X	X	All other values reserved

TABLE 1.4: SUB DEVICE CLASS FIELD FOR THE 'COMPUTER' MAJOR CLASS

5. MINOR DEVICE CLASS FIELD - PHONE MAJOR CLASS

7	6	5	4	3	2	Minor Device Class bit no of CoD
0	0	0	0	0	0	Uncategorized, code for device not assigned
0	0	0	0	0	1	Cellular
0	0	0	0	1	0	Cordless
0	0	0	0	1	1	Smart phone
0	0	0	1	0	0	Wired modem or voice gateway
0	0	0	1	0	1	Common ISDN Access
0	0	0	1	1	0	Sim Card Reader
X	X	X	X	X	X	All other values reserved

6. MINOR DEVICE CLASS FIELD - LAN/NETWORK ACCESS POINT MAJOR CLASS

7	6	5	Minor Device Class bit no of CoD
0	0	0	Fully available
0	0	1	1 - 17% utilized
0	1	0	17 - 33% utilized
0	1	1	33 - 50% utilized
1	0	0	50 - 67% utilized
1	0	1	67 - 83% utilized

1	1	0	83 - 99% utilized
1	1	1	No service available [REF #3]
X	X	X	All other values reserved

TABLE 1.6: THE LAN/NETWORK ACCESS POINT LOAD FACTOR FIELD

[Ref #3: "Device is fully utilized and cannot accept additional connections at this time, please retry later"]
The exact loading formula is not standardized. It is up to each LAN/Network Access Point implementation to determine what internal conditions to report as a utilization percentage. The only requirement is that the number reflects an ever-increasing utilization of communication resources within the box. As a recommendation, a client that locates multiple LAN/Network Access Points should attempt to connect to the one reporting the lowest load.

4	3	2	Minor Device Class bit no of CoD
0	0	0	Uncategorized (use this value if no other apply)
X	X	X	All other values reserved

TABLE 1.7: RESERVED SUB-FIELD FOR THE LAN/NETWORK ACCESS POINT

7. MINOR DEVICE CLASS FIELD - AUDIO/VIDEO MAJOR CLASS

7	6	5	4	3	2	Minor Device Class bit no of CoD
0	0	0	0	0	0	Uncategorized, code for device not assigned
0	0	0	0	0	1	Device conforms to the Headset profile
0	0	0	0	1	0	Hands-free
0	0	0	0	1	1	(Reserved)
0	0	0	1	0	0	Microphone
0	0	0	1	0	1	Loudspeaker
0	0	0	1	1	0	Headphones
0	0	0	1	1	1	Portable Audio
0	0	1	0	0	0	Car audio
0	0	1	0	0	1	Set-top box
0	0	1	0	1	0	HiFi Audio Device
0	0	1	0	1	1	VCR
0	0	1	1	0	0	Video Camera
0	0	1	1	0	1	Camcorder
0	0	1	1	1	0	Video Monitor
0	0	1	1	1	1	Video Display and Loudspeaker
0	1	0	0	0	0	Video Conferencing
0	1	0	0	0	1	(Reserved)

0	1	0	0	1	0	Gaming/Toy [Ref #4]
X	X	X	X	X	X	All other values reserved

[Ref #4: Only to be used with a Gaming/Toy device that makes audio/video capabilities available via Bluetooth]

TABLE 1.8: SUB DEVICE CLASSES FOR THE 'AUDIO/VIDEO' MAJOR CLASS

8. MINOR DEVICE CLASS FIELD - PERIPHERAL MAJOR CLASS

7	6	Minor Device Class bit no of CoD
0	1	Keyboard
1	0	Pointing device
1	1	Combo keyboard/pointing device
X	X	All other values reserved

TABLE 1.9: THE PERIPHERAL MAJOR CLASS KEYBOARD/POINTING DEVICE FIELD

Bits 6 and 7 independently specify mouse, keyboard or combo mouse/keyboard devices. These may be combined with the lower bits in a multifunctional device.

5	4	3	2	Minor Device Class bit no of CoD
0	0	0	0	Uncategorized device
0	0	0	1	Joystick
0	0	1	0	Gamepad
0	0	1	1	Remote control
0	1	0	0	Sensing device
0	1	0	1	Digitizer tablet
X	X	X	X	All other values reserved

TABLE 1.10: RESERVED SUB-FIELD FOR THE DEVICE TYPE

9. MINOR DEVICE CLASS FIELD - IMAGING MAJOR CLASS

7	6	5	4	Minor Device Class bit no of CoD
X	X	X	1	Display
X	X	1	X	Camera
X	1	X	X	Scanner
1	X	X	X	Printer
X	X	X	X	All other values reserved

TABLE 1.11: THE IMAGING MAJOR CLASS BITS 4 TO 7

Bits 4 to 7 independantly specify display, camera, scanner or printer. These may be combined in a multifunctional device.

3	2	Minor Device Class bit no of CoD
0	0	Uncategorized, default
X	X	All other values reserved

TABLE 1.12: THE IMAGING MAJOR CLASS BITS 2 AND 3

Bits 2 and 3 are reserved

Appendix 3 The Inquiry Access Codes

The General- and Device-Specific Inquiry Access Codes (DIACs)

The Inquiry Access Code is the first level of filtering when finding Bluetooth devices and services. The main purpose of defining multiple IACs is to limit the number of responses that are received when scanning devices within range.

0． 0x9E8B33 —— General/Unlimited Inquiry Access Code (GIAC)

1． 0x9E8B00 —— Limited Dedicated Inquiry Access Code (LIAC)

2． 0x9E8B01 ~ 0x9E8B32 RESERVED FOR FUTURE USE

3． 0x9E8B34 ~ 0x9E8B3F RESERVED FOR FUTURE USE

The Limited Inquiry Access Code (LIAC) is only intended to be used for limited time periods in scenarios where both sides have been explicitly caused to enter this state, usually by user action. For further explanation of the use of the LIAC, please refer to the Generic Access profile.

In contrast it is allowed to be continuously scanning for the General Inquiry Access Code (GIAC) and respond whenever inquired.