LinkMatik 2.0 Command Reference

FlexiPanel

Summary

LinkMatik 2.0's firmware layer (*"iWrap"*) is supplied to us by BlueGiga Technologies. Their reference manual is reproduced in the following pages.

Please contact FlexiPanel for technical support regarding the LinkMatik 2.0 *iWrap* firmware commands.

LinkMatik 2.0 Device Settings

LinkMatik 2.0 is supplied pre-configured for auto-slave mode and so some of the default settings are different to those described in the iWrap reference manual, viz:

- Baud rate is 9600 baud

- PIN is set to 0000

- Name is set to LinkMatik 2.0

- Class of device is set to cellphone

- PS-key *Map SCO over PCM* is *TRUE*

- *SET CONTROL ECHO 0* is specified.

- *SET CONTROL CONFIG 21* is specified.

- *SET CONTROL CD 4 0* is specified.

- *SET CONTROL ESCAPE – 8 1* is specified.

- *SET BT PAGEMODE 4 2000 1* is specified.

- *SET BT SNIFF* is specified.

LinkMatik Pin Names

The I/O output referred to as PIO2 in the *iWrap* documentation is referred to as ATN in the LinkMatik 2.0 documentation.

The I/O output referred to as PIO3 in the *iWrap* documentation is referred to as ESC in the LinkMatik 2.0 documentation.

iWRAP 2.2.0

bluegiga

T E C H N O L O G I E S

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VERSION HISTORY

Version:	Author:	Comments:
1.0	MSa	Initial Version, which is beta so information may change
1.1	MSa	Feature updates
1.2	MSa	Build 18 updates
1.3	MSa	Build 19 updates
1.4	MSa	Build 20 updates
1.5	MSa	Build 21 updates + HS comments
1.6	MSa	PAIR event documentation fixed

TERMS & ABBREVIATIONS

Term or Abbreviation:	Explanation:
BDR	Basic Data Rate
Bluetooth	Set of technologies providing audio and data transfer over short-range radio connections
bps	bits per second
CD	Carrier Detect
DTR	Data Terminal Ready
DUN	Dial-Up Networking Profile
EDR	Enhanced Data Rate
HCI	Host Controller Interface
iWRAP	Interface for WRAP – a trademark registered by Bluegiga Technologies

L2CAP	The Logical Link Control and Adaptation Layer Protocol
OPP	Object Push Profile
PARK state	Bluetooth low power mode
RFCOMM	Serial cable emulation protocol; element of Bluetooth
SNIFF mode	Bluetooth low power mode
SPP	Serial Port Profile
UART	Universal Asynchronous Receiver Transmitter
UUID	Universally Unique Identifier
VM	Virtual Machine
WRAP	Wireless Remote Access Platform; Bluegiga Technologies' wireless product family

1. INTRODUCTION

iWRAP is an embedded firmware running entirely in the RISC processor of LinkMatik 2 modules. It implements the full Bluetooth protocol stack, as is illustrated in the figure below and no host processor is required to run it. All software layers, including application software, run on the internal RISC processor in a protected user software execution environment known as a Virtual Machine (VM).

The host processor interfaces to iWRAP firmware via one or more of the physical interfaces, which are also shown in the figure below. The most common interfacing is done via UART interface using the ASCII commands supported by the iWRAP firmware. With these ASCII commands the host can access Bluetooth functionality without paying any attention to the complexity, which lies in the Bluetooth protocol stack.

The user may write application code, which runs on the host processor and controls iWRAP firmware with ASCII commands to easily develop Bluetooth powered applications.
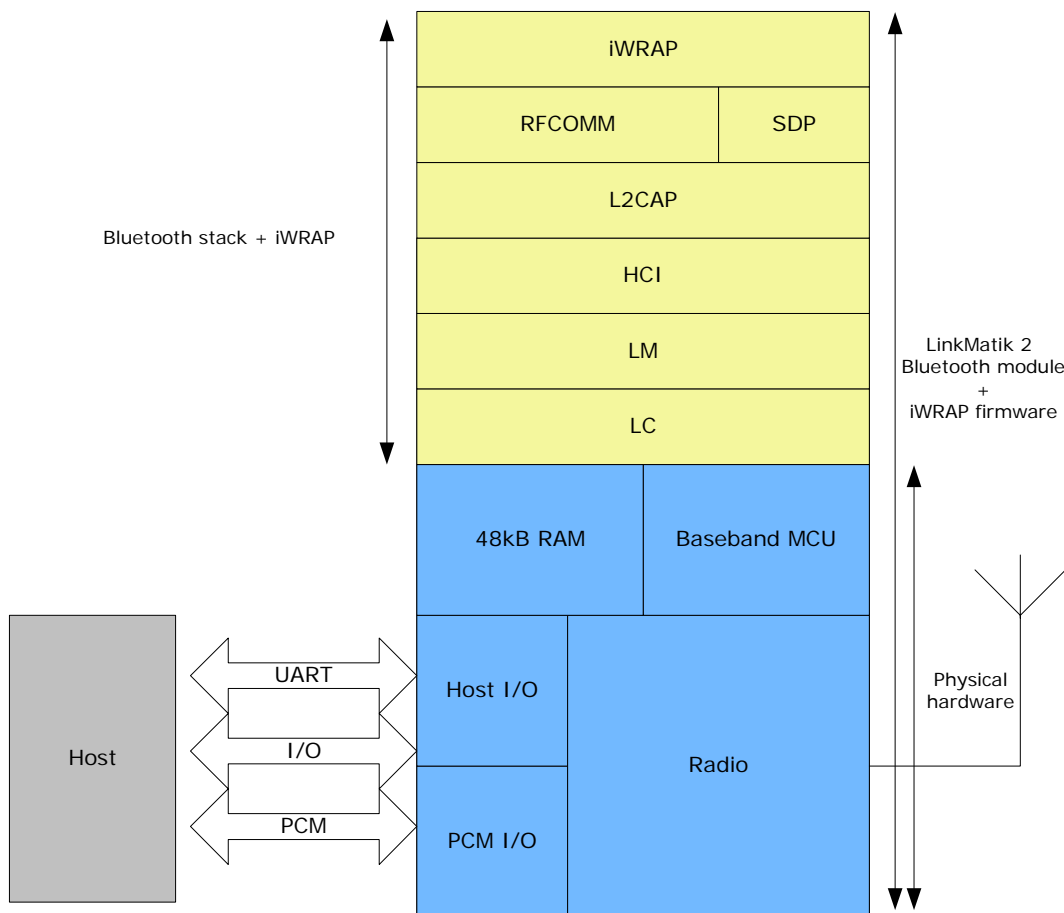
Figure 1: iWRAP Stack

In the figure above a LinkMatik 2 Bluetooth module equipped with iWRAP firmware is connected to a host system using UART interface.

1. If host system has a processor, software can be used to control iWRAP with ASCII based commands.

2. If there is no need to control iWRAP or host system does not have a processor, iWRAP can be configured to be totally transparent only accepting connections or automatically opening them. Not all the functionality will be available with this solution.

3. GPIO lines offered by LinkMatik 2 modules can be also used together with iWRAP to achieve extra functionality such as DTR signaling or Carrier Detect signals.

4. PCM interface can be used to transmit audio over a Bluetooth link.

2. GETTING STARTED

To start using the iWRAP, you can use, for example, terminal software such as *HyperTerminal*. When using the terminal software, make sure the LinkMatik 2 module is connected to your PCs serial port. By default iWRAP uses following UART settings:

- Baud rate: 9600bps

- Data bits: 8

- Stop bits: 1

- Parity bit: No parity

- HW Flow Control: Enabled

When you power up your LinkMatik 2 module or evaluation kit you may see the command prompt appear on screen of the terminal software, if startup banner is enabled.
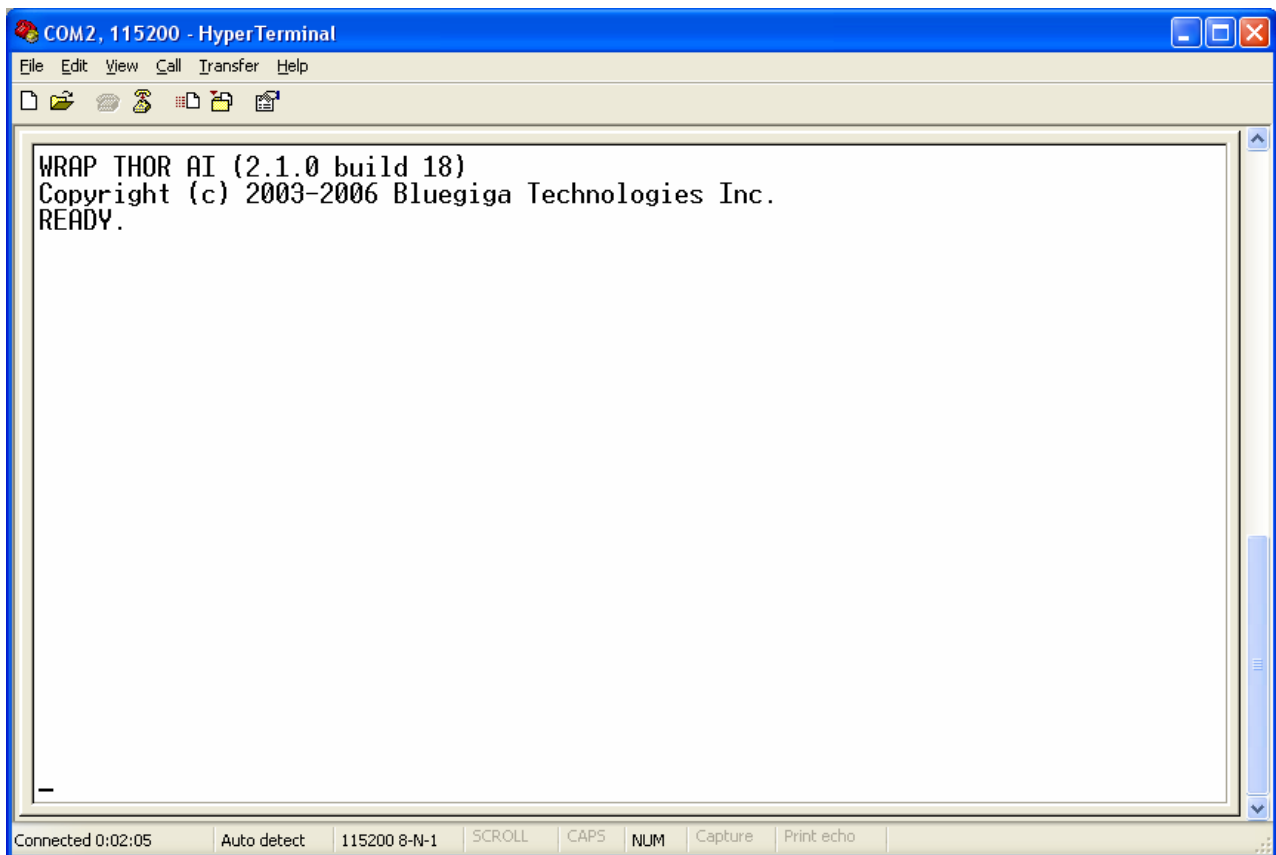
Figure 2: iWRAP boot prompt

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3. IWRAP MODES

iWRAP has two operational modes, **command mode** and **data mode**. Command mode is default mode when there are no connections. It is possible to switch between modes at any time when there are one or more active connections. Data mode is not available if there are no active connections, because obviously there is no any data available, nor it can be sent anywhere.

```
                    ┌─────────────┐
                   (   Command    )
                   (     Mode     )
                    └─────────────┘
```

- CONNECT
- RING
- Escape sequence
- SELECT cmd.

- NO CARRIER
- Escape sequence
- DTR switch

```
                    ┌─────────────┐
                   (  Data Mode   )
                    └─────────────┘
```
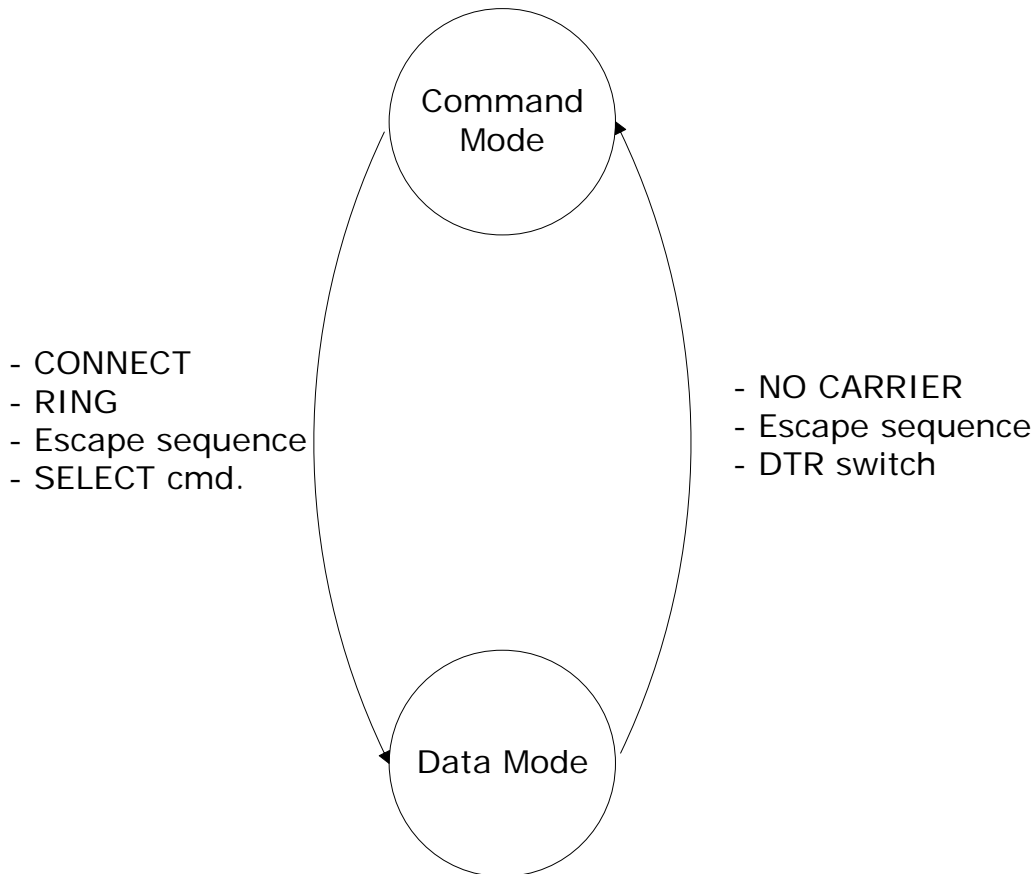
Figure 3: State Transitions

Switching from data mode to command mode is issued with the following escape sequence:

<At least 1 second sleep> esc esc esc <at least 1 second sleep>

esc = escape character

or it can also be done by using DTR signals.

Same sequence or **SELECT** -command may be used to return to data mode.

Note:

- When iWRAP enters to command mode **READY** event occurs

  (Unless masked away with **"SET CONTROL ECHO"** command.)

- Escape character can be changed with **"SET CONTROL ESCAPE"** –command.

- DTR mode can be enabled with **"SET CONTROL ESCAPE"** –command.

3.1 Command Mode

Command mode is default mode when iWRAP is powered up. In command mode ASCII commands can be entered to iWRAP to perform various functions.

Note:

- Incoming data from remote devices is buffered when iWRAP is in command mode.

- Because of embedded nature of iWRAP buffering capabilities are low and only small amounts of data can be received to buffers. The amount of data which can be buffered depends on the firmware version and the state of iWRAP. Usually it is around 2 Kbytes, but may vary radically.

3.2 Data mode

Data mode is default mode when there are one or more connections. In data mode all data is sent transparently from UART over the Bluetooth RFCOMM link to other device and vice versa.

Initial mode	Target mode	Requirements for transition from initial mode to target mode
Command Mode (no active connection) In this mode ASCII command can be given to iWRAP.	Data Mode	Connection is successfully created using **CALL** command. (**CONNECT** event is used to notify a successful link creation). Remote device has connected us. (**RING** event is used to notify of incoming connections.)
Data Mode In this mode all data can be sent transparently from RS-232 over the Bluetooth RFCOMM link to the other device.	Command Mode	User switches mode using escape sequence <1s>*esc esc esc*<1s> or by setting DTR low. Link is terminated (closed by remote device or link loss). (**NO CARRIER** event is used to inform of link termination.)
Command Mode (active connection) In this mode ASCII command can be given to iWRAP.	Data Mode	User switches mode either using escape sequence **<1s>*esc esc esc*<1s>**, or using command **SELECT**.

Table 1: iWRAP modes and transitions

3.3 Multiplexing mode

In iWRAP 2.1.0 and newer there is a special mode called 'multiplexing mode'. In this mode iWRAP does not have separate command or data modes, but data, commands and events are all handled in one single mode. There is however a special protocol to separate commands and events from the actual data, which needs to be used between the host system and iWRAP firmware.

The advantage of this multiplexing mode is that several Bluetooth connections can be handled simultaneously and there is no need to do time consuming data-command-data mode switching.

To learn more about multiplexing mode, please see the description of **"SET CONTROL MUX"**.

3.4 Audio mode

IWRAP 2.2.0 and newer version support several Bluetooth audio profiles, such as Hands-Free and Hands-Free Audio Gateway.

Audio mode is similar to multiplexing mode i.e. data can be transferred and iWRAP commands can be given in the same mode. However the difference to multiplexing mode is that no special packet mode needs to be used.

4. TECHNICAL DETAILS

Feature:	Value:
MAX simultaneous ACL connections	4
MAX simultaneous SCO connections	1
MAX data rate	650Kbps (WT12/WT11 to BT2.0 USB-dongle) 570Kbps (WT12/WT11 to WT12/WT11) 450Kbps (WT12/WT11 to BT1.1-BT1.2 device)
MAX UART baud rate	921600 bps
MIN transmission delay	8-15ms
PIN code length	Configurable from 0 to 16 characters
Encryption length	Configurable from 0 to 128 bits
MAX simultaneous pairings	16
MAX Friendly name length	Configurable up to 248 characters
RFCOMM Packet size	Configurable from 21 to 1008
Supported Bluetooth profiles	GAP, SPP, Hands-Free, Hands-Free Audio-Gateway, OPP*, DUN*
Supported power saving modes	Sniff, Park and Deep sleep

Table 2: Technical details

*) Limited support

5. USAGE

iWRAP can be used and controlled from the host system by sending ASCII commands through UART interface.

When installed and configured the module can be commanded from the host with the following ASCII commands:

- BER

- CALL

- CLOSE

- HELP

- INFO

- INQUIRY

- IC

- LIST

- NAME

- RSSI

- RESET

- SCO

- SDP

- SELECT

- **SET**

- SLEEP

- TESTMODE

- TXPOWER

- **BCSP_ENABLE**

- **BOOT**

- **TEST**

- **PING**

- **ECHO**

Note:

These commands should end with line feed **"\n"** character.

5.1 Typographical conventions

The ASCII commands and their usage are described further in this chapter. Commands and output synopsis are presented as follows:

Synopsis:
COMMAND {*required parameter*} [*optional parameter*] STATIC TEXT [*2ND OPTIONAL PARAMETER*]

Command parameters on the other hand are described like this:

Description:	
parameter	Description

Responses to the command are described as in the table below:

Response:	
RESPONSE {*parameters*}	
parameter	Description

Events generated by commands or actions are described as follow:

Events:	
<u>**EVENT**</u>	Description

List format is described as follow (only presented with SET commands):

Events:
COMMAND {*required parameter*} [*optional parameter*]

And finally examples shown are described like this:

EXAMPLE COMMAND
RESPONSE TO COMMAND
(comments)

NOTE!

- The parser is not case sensitive!

- ASCII interface 0.0.2 does not accept backspaces, but version 2.0.0 and later do.

5.2 CALL

CALL command is used to initiate connections to the remote device. Connections are closed using command **CLOSE**. Currently open connections can be viewed using command **LIST**.

5.2.1 Syntax

Synopsis:
CALL {*address*} {*target*} {connect_mode} [*MTU {packet size}*]

Description:	
address	Bluetooth address of the remote device

target	RFCOMM, HFP or HFP-AG target for the connection. Target may be one of the following:
	
	channel
	
	    RFCOMM channel number
	
	    HFP channel number
	
	    HFP-AG channel number
	
	    Format: xx (hex)
	
	uuid16
	
	    16 bit UUID for searching channel
	
	    Format: xxxx (hex)
	
	uuid32
	
	    32 bit UUID for searching channel
	
	    Format: xxxxxxxx (hex)
	
	uuid128
	
	    128 bit UUID for searching channel
	
	    Format: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (hex)

connect_mode	Defines the mode of connection to be established. Possible modes:

	RFCOMM
	Normal RFCOMM connection
	HFP
	Opens a connection in Hands Free device mode.
	HFP-AG
	Opens a connection in Hands Free Audio Gateway mode.
MTU	Optional static text to indicate that packet size parameter is in use.
packet size	Packet size to use (Values from 21 to 1008 can be used).

Response:
CALL {*link_id*}

link_id	Numeric connection identifier

Events:	
<u>CONNECT</u>	Delivered if **CALL** command is successful.
<u>NO CARRIER</u>	Delivered if **CALL** command fails.
<u>PAIR</u>	If **<u>PAIR</u>** event is enabled with "**SET CONTROL CONFIG**" it will be displayed during call if paring has to be done.

5.2.2 Examples

Creating successful connection to 00:07:80:80:52:27 using channel 1.

```
CALL 00:07:80:80:52:27 1 RFCOMM
CALL 0
CONNECT 0 RFCOMM 1
```

Creating successful connection to 00:07:80:80:52:27 using Serial Port Profile.

(UUID16 SPP = 1101)

```
CALL 00:07:80:80:52:27 1101 RFCOMM
CALL 0
CONNECT 0 RFCOMM 1
```

Unsuccessful connection attempt to 00:07:80:80:52:26.

```
CALL 00:07:80:80:52:26 1 RFCOMM
CALL 0
NO CARRIER 0 ERROR 406 RFC_CONNECTION_FAILED
```

Creating successful connection to 00:07:80:80:52:27 with MTU 600.

```
CALL 00:07:80:80:52:27 1101 RFCOMM MTU 600
CALL 0
CONNECT 0 RFCOMM 1
```

NOTE!

If **CALL** is used with **CHANNEL** instead of **UUID** it will be on average around 300ms faster, since there is no need to do service discovery. However the channel of serial port profile (SPP) must be known. Notice that the channel for a specific service may vary between different *Bluetooth* devices.

In iWRAP the channel for SPP is always 1 however.

5.3 CLOSE

Command **CLOSE** is used to terminate previously opened connection.

5.3.1 Syntax

Synopsis:
CLOSE { *link_id***}**

Description:	
link_id	Numeric connection identifier from previously used command **CALL** or from event **RING**.

Response:
No response

Events:	
NO CARRIER	This event is delivered after link is closed.

5.3.2 Examples

Closing an active connection:

```
CALL 00:60:57:a6:56:49 1103 RFC
CALL 0
CONNECT 0 RFCOMM 1
[+++] (mode switch)
READY.
CLOSE 0
NO CARRIER 0 ERROR 0
```

5.4 INQUIRY

Command **INQUIRY** is used to find other Bluetooth devices in the area (making device discovery).

5.4.1 Syntax

Synopsis:
INQUIRY {*timeout***} [***NAME***] [***LAP* {***lap***}]**

Description:	
timeout	The maximum amount of time (in units of 1.28 seconds) before the inquiry process is halted.
NAME	Optional flag to automatically request friendly name for found devices. See command **NAME** for more information about remote name request.
LAP	Optional flag for specifying that inquiry access code is in use.
lap	Value for inquiry access code. Can have following values: **0x9e8b33** General/Unlimited Inquiry Access Code (GIAC). This is the default value unless "**SET BT LAP**" is used. **0x9e8b00** Limited Dedicated Inquiry Access Code (LIAC). **0x9e8b01-0x9e8b32, 0x9e8b34-0x9e8b3f** Reserved for future use.

Response:	
INQUIRY {*num_of_devices*} and INQUIRY {*addr*} {*class_of_device*}	
num_of_devices	Amount of found devices
addr	Bluetooth address of a found device
class_of_device	Bluetooth Class of Device of a found device

Events:	
__INQUIRY_PARTIAL__	These events are delivered as devices are found.
__NAME__	These events are delivered after **INQUIRY** if *NAME* flag is present.

NOTE!

It may take up to 10.24 seconds for Bluetooth device to answer inquiry scan and thus timeout value should be at least 8 if it is necessary to find every device in the area.

*) iWRAP 2.1.0 and later support RSSI in the inquiry but this feature must be enabled with **"SET CONTROL CONFIG"** –command.

If set **"SET BT LAP"** is in use there is no need to use *[LAP {lap}]* in the **INQUIRY**.

__INQUIRY_PARTIAL__ events can be masked off with **"SET CONTROL ECHO"** command.

5.4.2 Examples

Basic INQUIRY command:

```
INQUIRY 1
INQUIRY_PARTIAL 00:14:a4:8b:76:9e 72010c
INQUIRY_PARTIAL 00:10:c6:62:bb:9b 1e010c
INQUIRY_PARTIAL 00:10:c6:4d:62:5c 72010c
INQUIRY_PARTIAL 00:10:c6:3a:d8:b7 72010c
INQUIRY_PARTIAL 00:02:ee:d1:80:6d 520204
INQUIRY_PARTIAL 00:10:c6:62:bb:fa 1c010c
INQUIRY 6
INQUIRY 00:14:a4:8b:76:9e 72010c
INQUIRY 00:10:c6:62:bb:9b 1e010c
INQUIRY 00:10:c6:4d:62:5c 72010c
INQUIRY 00:10:c6:3a:d8:b7 72010c
INQUIRY 00:02:ee:d1:80:6d 520204
INQUIRY 00:10:c6:62:bb:fa 1c010c
```

INQUIRY command with NAME resolution:

```
INQUIRY 1 NAME
INQUIRY_PARTIAL 00:10:c6:3a:d8:b7 72010c
INQUIRY_PARTIAL 00:10:c6:62:bb:9b 1e010c
INQUIRY_PARTIAL 00:14:a4:8b:76:9e 72010c
INQUIRY 3
INQUIRY 00:10:c6:3a:d8:b7 72010c
INQUIRY 00:10:c6:62:bb:9b 1e010c
INQUIRY 00:14:a4:8b:76:9e 72010c
NAME 00:10:c6:3a:d8:b7 "TOM"
NAME 00:10:c6:62:bb:9b "CSLTJANI"
NAME 00:14:a4:8b:76:9e "SWLTMIKKO_3"
```

INQUIRY command with LAP in use:

```
INQUIRY 3 LAP 9e8b11
INQUIRY_PARTIAL 00:07:80:80:52:15 111111
INQUIRY_PARTIAL 00:07:80:80:52:27 111111
INQUIRY 2
INQUIRY 00:07:80:80:52:15 111111
INQUIRY 00:07:80:80:52:27 111111
```

INQUIRY command with RSSI enabled:

```
INQUIRY 1
INQUIRY_PARTIAL 00:10:c6:62:bb:9b 1e010c "" -71
INQUIRY_PARTIAL 00:10:c6:4d:62:5c 72010c "" -73
INQUIRY_PARTIAL 00:10:c6:3a:d8:b7 72010c "" -73
INQUIRY 5
INQUIRY 00:10:c6:62:bb:9b 1e010c
INQUIRY 00:10:c6:4d:62:5c 72010c
INQUIRY 00:10:c6:3a:d8:b7 72010c
```

5.5 IC

IC (inquiry cancel) command can be used to stop on-going **INQUIRY**.

5.5.1 Syntax

Synopsis:
IC

Description:
No Description

Response:	
INQUIRY {*num_of_devices*}	
INQUIRY {*addr*} {*class_of_device*}	
num_of_devices	Amount of found devices
addr	Bluetooth address of a found device
class_of_device	Bluetooth Class of Device of a found device

Events:
None

5.5.2 Examples

Canceling INQUIRY command:

```
INQUIRY 5
INQUIRY_PARTIAL 00:14:a4:8b:76:9e 72010c
INQUIRY_PARTIAL 00:10:c6:62:bb:9b 1e010c
IC
INQUIRY 2
INQUIRY 00:14:a4:8b:76:9e 72010c
INQUIRY 00:10:c6:62:bb:9b 1e010c
```

5.6 LIST

Command **LIST** shows information about active connections.

5.6.1 Syntax

Synopsis:
LIST

Description:
No Description

Response:
LIST {*num_of_connections*} **LIST {*link_id*} CONNECTED RFCOMM {*blocksize*} 0 0 {*elapsed_time*} {*local_msc*} {*remote_msc*} {*addr*} {*channel*} {*direction*} {*powermode*} {*role*} {*crypt*}***

link_id	Numeric connection identifier
blocksize	RFCOMM data packet size, i.e. how many bytes data can be sent in one packet
elapse_time	Link life time in seconds
local_msc	Local serial port status bits, "8d" is normal value
remote_msc	Remote serial port status bits, "8d" is normal value
addr	Bluetooth device address of the remote device
channel	RFCOMM channel number at remote device
direction	Direction of the link **OUTGOING** Link is initiated by local device (using command **CALL**) **INCOMING**

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	Link is initiated by the remote device
powermode	Power mode for the link **ACTIVE** Link is in active mode **SNIFF** Link is in sniff mode **HOLD** Link is in hold mode **PARK** Link is in park mode
role	Role of the link **MASTER** iWRAP is the master device of this link **SLAVE** iWRAP is the slave device of this link
crypt	Encryption state of the link **PLAIN** Link is not encrypted **ENCRYPTED** Link is encrypted

Events:
No response

5.6.2 Examples

Listing active connections

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
```

5.7 NAME

Command **NAME** is used to retrieve friendly name of the device.

5.7.1 Syntax

Synopsis:
NAME {*address*}

Description:	
address	Address of the Bluetooth device

Response:
No response

Events:	
NAME	These events are delivered after **INQUIRY** if *NAME* flag is present.
NAME_ERROR	These events are delivered if name resolution fails.

5.7.2 Examples

Successful name resolution

```
NAME 00:07:80:bf:bf:01
NAME 00:07:80:bf:bf:01 "iWRAP_2.1.0"
```

Unsuccessful name resolution

```
NAME 00:07:80:bf:bf:01
NAME ERROR 0x104 00:07:80:bf:bf:01 HCI_ERROR_PAGE_TIMEOUT
```

5.8 RESET

Command **RESET** is used to reset iWRAP.

5.8.1 Syntax

Synopsis:
RESET

Description:
No description

Response:
No response

5.9 SELECT

Command **SELECT** is used to switch to data mode.

5.9.1 Syntax

Synopsis:
SELECT { *link_id***}**

Description:	
link_id	Numeric connection identifier

Response:	
No response if valid link is selected. iWRAP goes to data mode of the link *link_id*.	

Events:	
SYNTAX ERROR	This event occurs if invalid *link_id* is given

5.9.2 Examples

Changing between links

```
LIST
LIST 2
LIST 0 CONNECTED RFCOMM 668 0 0 243 8d 8d 00:07:80:80:38:77 1 OUTGOING ACTIVE
MASTER ENCRYPTED
LIST 1 CONNECTED RFCOMM 668 0 0 419 8d 8d 00:07:80:80:36:85 1 OUTGOING ACTIVE
MASTER ENCRYPTED
SELECT 1      (iWRAP goes to DATA mode – Device: 00:07:80:80:36:85)
```

5.10 INFO

Displays information about iWRAP version and features.

5.10.1 Syntax

Synopsis:
INFO

Description:

Response:
Information about iWRAP version and features.

Events:
None.

5.10.2 Examples

```
INFO
WRAP THOR AI (2.1.0 build 20)
Copyright (c) 2003-2006 Bluegiga Technologies Inc.
Compiled on Mar  1 2006 13:39:55, running on WT12 module, psr v5
      - BOCK3 version 15 (Mar  1 2006 13:38:28) (max acl/sco 7/1)
      - Bluetooth version 2.0, Power class 2
      - Firmware version 2626
      - up 0 days, 22:34, 0 connections (pool 1)
READY.
```

6. SET

With **SET** command different configuration values of iWRAP can be displayed or configured.

6.1.1 Syntax of SET commands

Synopsis:
SET [{*category***} {***option***} {***value***}]**

Description:
Without any parameters **SET** displays current configuration.

category	Category of setting
	
	PROFILE
	
	    Enables or disables the Bluetooth profiles iWRAP can support.
	
	BT
	
	    Changes different Bluetooth related settings. See **SET BT** for more information about options.
	
	CONTROL
	
	    Changes different iWRAP settings. See **SET CONTROL** for more information about options.
	
	link_id
	
	    This command is used to control the various settings related to Bluetooth links in iWRAP. These are for example master, slave and power save modes (SNIFF, PARK, and ACTIVE).

option	Option name, depends on category. See following sections for more information.
value	Value for option. See following sections for more information.

Response:	
If issued without parameters	
SET {*category*} {*option*} {*value*}	Displays current settings of iWRAP.
None if issued with parameters	

Events:
None

6.1.2 Examples

Listing current settings

```
SET
SET BT BDADDR 00:07:80:80:c2:37
SET BT NAME WT12
SET BT CLASS 50020c
SET BT AUTH * 9078
SET BT LAP 9e8b33
SET BT PAGEMODE 4 2000 1
SET BT PAIR 00:07:cf:51:f6:8d 9c4e70d929a83812a00badba7379d7c2
SET BT PAIR 00:14:a4:8b:76:9e 90357318b33817002c5c13b62ac6507f
SET BT PAIR 00:60:57:a6:56:49 3b41ca4f42401ca64ab3ca3303d8ccdc
SET BT ROLE 0 f 7d00
SET BT SNIFF 0 20 1 8
SET CONTROL BAUD 115200,8n1
SET CONTROL CD 80 0
SET CONTROL ECHO 7
SET CONTROL ESCAPE 43 00 1
SET
```

6.2 SET PROFILE

SET PROFILE command can be used to enable or disable the available Bluetooth profiles: SPP, OPP, HFP and HFP-AG.

6.2.1 Syntax

Synopsis:
SET PROFILE {*profile_name*} [*SDP_name*]

Description:	

profile_name	Specify the profile to be enabled or disabled. Possible profile acronyms are:
	
	HFP
	
	      Hands Free Profile
	
	HFP-AG
	
	      Hands Free Profile Audio Gateway
	
	SPP
	
	      Serial Port Profile
	
	OPP
	
	      Object Push Profile (server)

SDP_name	With this parameter you can set the name for this service. If '**on**' is used, default profile name will be used. If this parameter is not given, the profile in will be **disabled**.

Response:
No response

Note!

iWRAP needs to be reset after profile configuratein, for the settings to take place.

If you want to use audio profiles, enable also the support for SCO links, by setting SET CONTROL CONFIG **bit 8** to 1. If no other features of the SET CONTROL CONFIG command are used, the SCO links are enabled by issuing command: '**SET CONTROL CONFIG 100**'.

6.2.2 Examples

Example of enabling HFP profile.

```
SET PROFILE HFP My Hands-Free
SET
SET BT BDADDR 00:07:80:80:c2:37
SET BT NAME WT12
SET BT CLASS 001f00
SET BT AUTH * 6666
SET BT LAP 9e8b33
SET BT PAGEMODE 4 2000 1
SET BT ROLE 0 f 7d00
SET BT SNIFF 0 20 1 8
SET CONTROL BAUD 115200,8n1
SET CONTROL CD 80 0
SET CONTROL ECHO 7
SET CONTROL ESCAPE 43 00 1
SET CONTROL MSC DTE 00 00 00 00 00 00
SET PROFILE HFP My Hands-Free
SET PROFILE SPP Bluetooth Serial Port
SET
RESET
```

6.3 SET BT BDADDR

Shows the local devices Bluetooth address.

6.3.1 Syntax

Synopsis:
No description, since the value is read only.

Description:
No description

Response:
None

Events:
None

List format:	
SET BT BDADDR { *bd_addr* **}**	
bd_addr	Bluetooth device address of local device

Note:

This value is read-only!

6.4 SET BT NAME

Shows or sets the local devices friendly name.

6.4.1 Syntax

Synopsis:
SET BT NAME { *friendly_name***}**

Description:	
friendly_name	Friendly name of the local device

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT NAME { *friendly_name***}**

Note:

Maximum length of friendly name is 16 characters in iWRAP 2.0.2 and older. In iWRAP 2.1.0 and newer versions the maximum length is 256 characters.

If *friendly_name* is left empty some devices (like PCs or PDAs) may have problems showing the device in the inquiry.

6.5 SET BT CLASS

Shows or sets the local devices Class-of-Device (CoD).

Class of device is a parameter which is received during the device discovery procedure, indicating the type of device and which services are supported.

6.5.1 Syntax

Synopsis:
SET BT CLASS {*class_of_device***}**

Description:	
class_of_device	CoD of the local device

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT CLASS {*class_of_device***}**

6.6 SET BT LAP

This command configures the Inquiry Access code (IAC) that iWRAP uses. IAC is used in inquiries and inquiry responses.

6.6.1 Syntax

Synopsis:
SET BT LAP { *iac* **}**

Description:	
iac	Value for inquiry access code. Can have following values: **0x9e8b33** General/Unlimited Inquiry Access Code (GIAC). This is the default value. **0x9e8b00** Limited Dedicated Inquiry Access Code (LIAC). **0x9e8b01 - 0x9e8b32** and **0x9e8b34-0x9e8b3f** Reserved for future use.

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT LAP { *iac* **}**

Note:

IAC is very useful in cases where the module needs to be visible in the inquiry but only for dedicated devices, like other iWRAP modules, but not for standard devices like PC's or mobile phones. When the value of IAC is the default one (**0x9e8b33**) it's visible for all devices capable of making an inquiry. On the other hand when one of the following values **0x9e8b01-0x9e8b32** and **0x9e8b34-0x9e8b3f** is used only devices sharing the same code will see each other in the inquiry. This will also speed up inquiry process in since only the devices we want to see will respond, and not any other random Bluetooth devices.

See also: **INQUIRY**

6.7 SET BT AUTH

Shows or sets the local devices PIN code.

6.7.1 Syntax

Synopsis:
SET BT AUTH * {*pin_code*}

Description:	
pin_code	Pin code for authorized connections. Authorization is required if this option is present. Pin code can be anything from 0 to 16 digits.

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:	
	If pin code is not in use **SET BT AUTH** * is not displayed
SET BT AUTH * {*pin_code*}	If pin code is set

Note:

If command "***SET BT AUTH ***" is given, PIN code will be disabled and no encryption can be used.

6.8 SET BT PAIR

Displays or configures the local devices pairing information.

6.8.1 Syntax

Synopsis:
SET BT PAIR {*bd_addr***} {***link_key***}**

Description:	
bd_addr	Bluetooth address of the paired device
link_key	Link key shared between the local and the paired device. If this value is empty pairing for the given Bluetooth address will be removed. Link key is 32hex values long.

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:	
	SET BT PAIR is not displayed if there are no pairings
SET BT PAIR {*bd_addr***} {***link_key***}**	One line per pairing is displayed

Note:

iWRAP supports up to 16 simultaneous pairings. If 16 devices have been already paired no new pairings will be stored.

If command "**SET BT PAIR ***" is given all pairings will be removed.

6.9 SET BT PAGEMODE

Configures or displays the local devices page mode.

Page mode controls whether iWRAP can be seen in the inquiry and whether it can be connected. This command can also be used to change page timeout.

6.9.1 Syntax

Synopsis:
SET BT PAGEMODE {*page_mode*} {*page_timeout*} {*page_scan_mode*}

Description:	

page_mode	This parameter defines the Bluetooth page mode.
	
	0
	
	    iWRAP is NOT visible in the inquiry and does NOT answers calls
	
	1
	
	    iWRAP is visible in the inquiry but does NOT answers calls
	
	2
	
	    iWRAP is NOT visible in the inquiry but answers calls
	
	3
	
	    iWRAP is visible in the inquiry and answers calls
	
	4
	
	    Just like mode 3 if there are NO connections. If there are connections it's like mode 0. (default value)

page_timeout	**0001 – FFFF** Page timeout defines how long connection establishment can take before an error occurs. Page timeout is denoted as a hexadecimal number (HEX) and calculated as in the example below: 2000 (HEX) is 8192 (DEC). Multiply it by 0.625 and you'll get the page timeout in milliseconds. In this case it's 5120 ms (8192 * 0,625ms).
page_scan_mode	This parameter configures the Bluetooth page scan mode

	0
	Mode R0 means that iWRAP IS connectable all the time, but NOT visible in inquiry.
	1
	Mode R1 means that iWRAP is connectable every 1.28 sec (Default value)
	2
	Mode R2 means that iWRAP is connectable every 2.56 sec (Lowest power consumption)

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT PAGEMODE {*page_mode*} {*page_timeout*} {*page_scan_mode*}

Note:

Command "**SET BT PAGEMODE**" returns default values.

6.10 SET BT ROLE

This command configures or displays the local devices role configuration. With "**SET BT ROLE**" command iWRAP's master-slave behavior can be configured. Command can also be used to set supervision timeout and link policy.

6.10.1 Syntax

Synopsis:
SET BT ROLE {*ms_policy***} {***link_policy***} {***supervision_timeout***}**

Description:	
ms_policy	This parameter defines how master-slave policy works.
	0
	This value allows master-slave switch when calling but iWRAP does not request it when answering (default value).
	1
	This value allow master-slave switch when calling, and iWRAP requests it when answering.
	2
	If this value is set master-slave switch is not allowed when calling, but it's request for when answering.
link_policy	This bitmask controls the link policy modes. It is represented in hexadecimal format.
	Bit 1
	If this bit is set, Role switch is enabled
	Bit 2
	If this bit is set, Hold mode is enabled
	Bit 3
	If this bit is set, Sniff mode is enabled
	Bit 4
	If this bit is set, Park state is enabled
	F

	This value enables all of the above modes (default)
	0
	This value disables all of the above modes
supervision_timeout	**0001 – FFFF**
	Supervision timeout controls how long a Bluetooth link is kept open if remote end does not answer. Supervision timeout is denoted as a hexadecimal number (HEX) and is calculated as in the example below:
	12C0 (HEX) is 4800 (DEC). Multiply it by 0.625 and you'll get the supervision timeout in milliseconds. In this case it's 3000 ms (4800 * 0,625ms).
	So remote end can be silent for 3 seconds until connection will be closed.

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT ROLE {*ms_policy***} {***link_policy***} {***supervision_timeout***}**

Note:

Command **"SET BT ROLE"** returns default values.

6.11 SET BT SNIFF

This command enables automatic sniff mode for Bluetooth connections. Notice that remote devices may not support sniff.

6.11.1 Syntax

Synopsis:
SET BT SNIFF {*max***}{***min***} [{***attempt***} {***timeout***}]**   or   **SET BT SNIFF {***avg***}**

Description:	
max	Maximum acceptable interval in milliseconds
mix	Maximum acceptable interval in milliseconds
avg	Average value in milliseconds. Shortcut for easier sniff setting.
attempt	Number of SNIFF attempts (default value 1)
timeout	SNIFF timeout (default value 8)

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET BT SNIFF {*max***}{***min***} {***attempt***} {***timeout***}**

Note:

"**SET BT SNIFF 0**" disables automatic sniff mode (default setting).

6.12 SET BT POWER

This command changes the TX power parameters of the LinkMatik 2 module.

6.12.1 Syntax

Synopsis:
SET BT POWER [RESET] [default] [maximum]

Description:	
RESET	Returns default values and resets iWRAP
default	Default TX power in dBm (user for **CALL**, **INQUIRY** and **NAME**)
maximum	Maximum TX power in dBm

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
None

6.12.2 Examples

Change TX power to class 2 setting:

SET BT POWER 0 4

Note:

Please see the table below, which sets the requirements for TX power:

Power class:	Max. TX power:	Nominal TX power:	Minimum TX power:
1	20 dBm	N/A	0dBm
2	4dBm	0dBm	-6 dBm
3	0dbm	N/A	N/A

Table 3: Power classes as defined in Bluetooth specification

The values passed with "**SET BT POWER**" will always be rounded to the next available value is radio power table.

If possible always use default values!

6.13 SET CONTROL AUTOCALL

Enables or disables the AUTOCALL functionality in iWRAP.

When AUTOCALL feature is enabled iWRAP tries to form a connection with a paired (see. **"SET BT PAIR"**) device until the connection is established. If connection is lost or closed iWRAP tries to reopen it.

If there are several paired devices in iWRAP memory, an inquiry (transparent to the user) is made and first paired device found is connected.

6.13.1 Syntax

Synopsis:
SET CONTROL AUTOCALL { *target***} {** *timeout***}**

Description:	
target	RFCOMM target for automatic connection
	channel
	RFCOMM channel number
	Format xxxx (HEX)
	uuid16
	16 bit UUID for searching the channel
	Format xxxx (HEX)
	uuid32
	32 bit UUID for searching the channel
	Format xxxxxxxx (HEX)
	uuid128
	128 bit UUID for searching the channel.
	Format xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (HEX)
timeout	Timeout between calls (in milliseconds)

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:	
	If AUTOCALL is not enabled **"SET CONTROL AUTOCALL"** will not be displayed
SET CONTROL AUTOCALL { *target***} {** *timeout***}**	When AUTOCALL enabled

6.13.2 Examples

To enable AUTOCALL to Serial Port Profile (using UUID) with timeout of 5000 ms:

```
SET CONTROL AUTOCALL 1101 5000
SET
SET BT BDADDR 00:07:80:80:c2:37
SET BT NAME WT12
SET BT CLASS 001f00
SET BT AUTH * 1
SET BT LAP 9e8b33
SET BT PAGEMODE 4 2000 1
SET BT PAIR 00:60:57:a6:56:49 d36c481fb6eb76a139f64c403d821712
SET BT ROLE 0 f 7d00
SET BT SNIFF 0 20 1 8
SET CONTROL AUTOCALL 1101 5000
SET CONTROL BAUD 115200,8n1
SET CONTROL CD 00 0
SET CONTROL ECHO 7
SET CONTROL ESCAPE 43 00 1
SET
```

Disabling AUTOCALL:

```
SET CONTROL AUTOCALL
SET
SET BT BDADDR 00:07:80:80:c2:37
SET BT NAME WT12
SET BT CLASS 001f00
SET BT AUTH * 1
SET BT LAP 9e8b33
SET BT PAGEMODE 4 2000 1
SET BT PAIR 00:60:57:a6:56:49 d36c481fb6eb76a139f64c403d821712
SET BT ROLE 0 f 7d00
```

```
SET BT SNIFF 0 20 1 8
SET CONTROL BAUD 115200,8n1
SET CONTROL CD 00 0
SET CONTROL ECHO 7
SET CONTROL ESCAPE 43 00 1
SET
```

Note:

Autocall can only be used with RFCOMM connections, not with SCO connections.

6.14 SET CONTROL BAUD

This command changes the local devices UART settings.

6.14.1 Syntax

Synopsis:
SET CONTROL BAUD {*baud_rate*},8{*parity*}{*stop_bits*}

Description:	
baud_rate	UART baud rate in bps. See modules data sheet for suitable values.

parity	UART parity setting
	
	n
	
	    None parity
	
	e
	
	    Even parity
	
	o
	
	    Odd parity

stop_bits	Number of stop bits in UART communications
	
	1
	
	    One stop bit
	
	2
	
	    Two stop bits

Response:
None

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET CONTROL BAUD {*baud_rate*},8{*parity*}{*stop_bits*}

6.14.2 Examples

Configuring local UART to 9600bps, 8 data bits, none parity and 1 stop bit

SET CONTROL BAUD 9600,8N1

6.15 SET CONTROL CD

This command enables or disables the carrier detect signal (CD) in iWRAP.

Carrier detect signal can be used to indicate that iWRAP has an active Bluetooth connection. With "**SET CONTROL CD**" command one PIO line can be configured to act as a CD signal.

6.15.1 Syntax

Synopsis:
SET CONTROL CD {*cd_mask***} {***datamode***}**

Description:	
cd_mask	This is a bit mask which defines the GPIO lines used for CD signaling For example for PIO5 value 20 (HEX) must be used. 20 (HEX) = 100000 (BIN) For PIO6 value is 40 40 (HEX) = 1000000 (BIN)

datamode	This parameter defines how carrier detect signal works.
	
	0
	
	      CD signal is driven high if there are one or more connections.
	
	1
	
	      CD signal is driven high only in data mode.

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET CONTROL CD {*cd_mask***} {***datamode***}**

6.16 SET CONTROL CONFIG

6.16.1 Syntax

This command enables or disables various functional features in iWRAP. These features are described below.

Synopsis:
SET CONTROL CONFIG {*configuration_value*}

Description:	
configuration_value	This value is a bit field (represented as a hexadecimal value) which is used to control various features in iWRAP. These features are described below:
	Bit 0
	If this bit is set RSSI value will be visible in the inquiry results
	Bit 1
	Not used. Must be set to 0.
	Bit 2
	"Interlaced inquiry scan". If this bit is set interlaced inquiry will be used. Generally interlaced inquiry is a little bit faster than regular inquiry.
	Bit 3
	"Interlaced page scan". If this bit is set interlaced page (call) will be used. Generally interlaced page is a little bit faster than regular page.
	Bit 4
	"Deep sleep enabled". If this bit is set 'Deep sleep' power saving mode will be used. Deep sleep is an aggressive power saving mode used when there are no connections.
	Bit 5
	"Bluetooth address in CONNECT". If this bit is set Bluetooth address of remote end will be displayed on CONNECT event.
	Bit 6
	Not used. Must be set to 0.

	Bit 7 Displays **PAIR** event after successful pairing. **Bit 8** Enables SCO links. This bit needs to be 1 if you use audio profiles.

Events:
SYNTAX ERROR   This event occurs if incorrect parameters are given

List format:
None

6.16.2 Examples

RSSI, deep sleep and interlaced inquiry and page scans enabled.

```
SET CONTROL CONFIG 1D
```

6.17 SET CONTROL ECHO

This command changes the echo-mode of iWRAP.

6.17.1 Syntax

Synopsis:
SET CONTROL ECHO {*echo_mask*}

Description:	
echo_mask	Bit mask for controlling echo and events displaying
	Bit 0
	If this bit is set start-up banner is visible.
	Bit 1
	If this bit is set characters are echoed back to client in command mode.
	Bit 2
	If set events are displayed when in command mode.

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET CONTROL ECHO {*echo_mask*}

Warning!

If every bit is set off (value 0) it is quite impossible to know the status of iWRAP.

If Bit 2 is set off it is very hard to detect whether iWRAP is in command mode or in data mode. This can however be solved if one IO is used to indicate that iWRAP is in data mode (**"SET CONTROL CD"**).

6.18 SET CONTROL ESCAPE

6.18.1 Syntax

This command can be used to change the escape character used to change between command and data mode. This command also enables and disables DTR signaling.

Synopsis:
SET CONTROL ESCAPE *{esc_char} {dtr_mask} {dtr_mode}*

Description:	
esc_char	Decimal ASCII character to define escape character used in escape sequence. Use "-" to disable escape sequence (default value 43 which is "+").
dtr_mask	Bit mask for selecting I/O pins used for DTR.
	For example for IO5 bit mask is **00100000** and **dtr_mask** is **20** (HEX).
dtr_mode	**0**
	DTR Disabled
	1
	Return to command mode when DTR is dropped.
	2
	Close active connection when DTR is dropped.
	3
	Reset iWRAP when DTR is dropped.

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given

List format:
SET CONTROL ESCAPE *{esc_char} {dtr_mask} {dtr_mode}*

6.18.2 Examples

How to disable default escape character "+" and configure DTR to PIO5.

SET CONTROL CD – 20 1

6.19 SET CONTROL INIT

Lists or changes the initialization command in iWRAP. This command is run when iWRAP is started or reset.

6.19.1 Syntax

Synopsis:
SET CONTROL INIT {*command*}

Description:	
command	Any of the available iWRAP commands. This command is automatically executed every time iWRAP starts (after power-on, RESET or watchdog event)

Events:
None

List format:
SET CONTROL INIT {*command*}

6.19.2 Examples

To remove all pairings after reset:

SET CONTROL INIT SET BT PAIR *

To change baud rate to 115200 bps after reset:

SET CONTROL INIT SET CONTROL BAUD 115200,8n1

6.20 SET CONTROL MUX

SET CONTROL MUX can be used to enable or disable the multiplexing mode. This chapter describes the usage of the command as well the operation of multiplexing mode.

6.20.1 Syntax

Synopsis:
SET CONTROL MUX {*mode*}

Description:	

mode	Multiplexing mode
	
	 0
	
	     Multiplexing mode disabled. Normal (data-command) mode enabled
	
	 1
	
	     Multiplexing mode enabled. Multiplexing protocol need to be used to talk to iWRAP.

Events:	
READY	Ready event occurs after successful mode change.

List format:	
	Nothing is displayed when multiplexing mode is disabled.
SET CONTROL MUX 1	This string is displayed when multiplexing mode is enabled.

6.20.2 Examples

To enable multiplexing mode:

```
SET CONTROL MUX 1
¿READY
```

Note:

When multiplexing mode is enabled no normal ASCII commands can be given to iWRAP but the multiplexing protocol must be used. Multiplexing mode can be disabled however by deleting PSKEY_USR30 with PSTool.

ASCII commands should not end with"\r\n" when multiplexing mode is in use.

6.20.3 Using multiplexing mode

The format of multiplexing protocol is presented below:

Length:	Name:	Description:	Value:
8 bits	SOF	Start of frame	0xBF
8 bits	LINK	Link ID	0x00 - 0x08 or 0xFF (control)
6 bits	FLAGS	Frame flags	0x00
10 bits	LENGTH	Size of data field in bytes	-
0-8192 bits	DATA	Data (max size 100 bytes!)	-
8 bits	nLINK	{LINK} XOR 0xFF	-

Table 4: Multiplexing frame format

When multiplexing mode is enabled all the commands and data send from host to iWRAP must be sent using the frame format described above instead of plain ASCII commands. Also the responses and data coming from iWRAP to the host are sent using the same format. iWRAP firmware autonomously processes the frames and decides whether they contain control commands or data which should be forwarded to its destination.

The advantage of multiplexing mode is that there is no need to do special command-data –command mode switching since data and commands are transmitted in the same mode. This saves a lot of time especially in multipoint scenarios - in the worst case switching from data mode to command mode can take more than two seconds.

Also in scenarios where there are several connection receiving data simultaneously from several devices is difficult if multiplexing mode is not used. In normal (data/command) mode only one connection can be active (in data mode) at a time, only it can be used to transmit or receive data. The data received from other connection which be stored in to small iWRAP buffers in the meanwhile and is received only when the connections become active (data mode of the connection enabled).

The next figure illustrates the host-iWRAP-host communications in multiplexing mode.

<0xBF> <0xFF> <0x00> <2> <AT> <0x00>

<0xBF> <0xFF> <0x00> <2> <OK> <0x00>
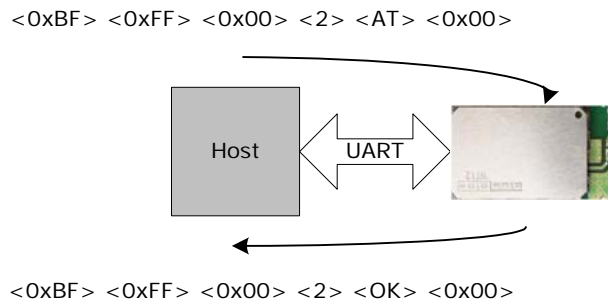
Figure 4: Host-iWRAP-Host communication

The second figure below illustrates host-iWRAP-remote device communication when multiplexing mode is in use. The key thing is that the remote device does not need to know anything about the multiplexing communication and frame format, but it sees the connection as a standard Bluetooth connection.

<0xBF> <0x00> <0x00> <len> <Data> <0xFF>

<0xBF> <0x00> <0x00> <len> <Data> <0xFF>
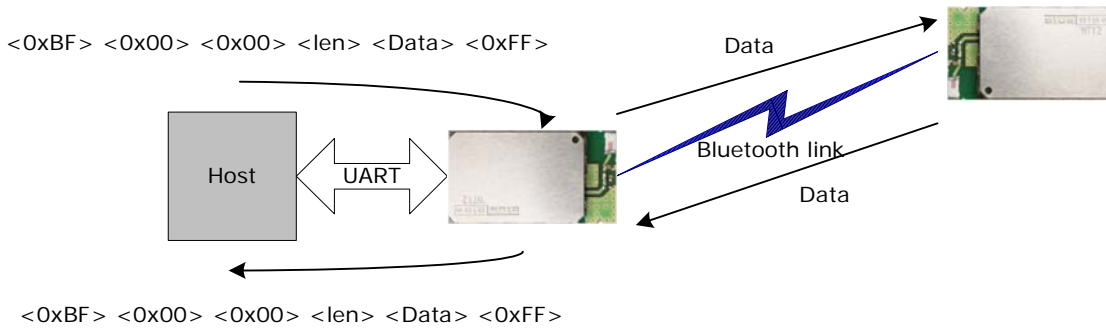
Figure 5: Host-iWRAP-remote device communications

At the moment four (4) simultaneous connections can be used in multiplexing mode.

On the next page there is a simple C-code example how to create a simple multiplexing frame containing an iWRAP command.

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```
//HOW TO CREATE A SIMPLE FRAME

char outbuf[128];         //Buffer for frame

char* cmd = "SET";        //ASCII command

int link = 0xff, pos=0;   //0xFF for control channel

int len = strlen(cmd);    //Calc. length of ASCII command

//Generate packet

outbuf[pos++]=0xbf;               //SOF

outbuf[pos++]=link;               //Link (0xFF=Control, 0x00 = connection 1, etc.)

outbuf[pos++]=len>>8;             //Flags

outbuf[pos++]=len & 0xff;         //Length

pos += len;

//Insert data into correct position in the frame

memmove(outbuf+pos cmd, len);

pos += len;                       //Move to correct position

outbuf[pos]=link^0xff;            //nlink
```

6.21 SET CONTROL BIND

With SET CONTROL BIND it is possible to bind PIO2 – PIO7 pins to read the activity on PIO line and respond according settings.

6.21.1 Syntax

Synopsis:
SET CONTROL BIND {*pri*} [*io_mask*] [*direction*] [*command*]

Description:	
pri	Priority of command. Determines the order in which the commands bound to PIO are executed. Range on values: 0 to 7.
io_mask	Determines what PIO is to be bind. This is a hexadecimal value. Example: Set PIO5. 100000bin (5^{th} bit is one) = 20hex

direction	Determines whether PIO is triggered on rising, falling or on both edges of the signal.
	
	Possible values:
	
	RISE
	
	      Command is executed on rising edge.
	
	FALL
	
	      Command is executed on falling edge.
	
	CHANGE
	
	      Command is executed on rising and falling edge.

command	Standard iWRAP command or string to be sent into active Bluetooth link.

Response:
No response

6.21.2 Examples

Example usage of binding PIO's:

SET CONTROL BIND 0 20 FALL CLOSE 0
SET CONTROL BIND 1 20 FALL SET BT PAIR *
SET

SET BT BDADDR 00:07:80:81:62:2a
SET BT NAME EKWT11_PR
SET BT CLASS 001f00
SET BT AUTH * 1234
SET BT LAP 9e8b33
SET BT PAGEMODE 4 2000 1
SET BT ROLE 0 f 7d00
SET BT SNIFF 0 20 1 8
SET CONTROL BAUD 115200,8n1
SET CONTROL BIND 0 20 F close 0
SET CONTROL BIND 1 20 F set bt pair *
SET CONTROL CD 80 0
SET CONTROL ECHO 7
SET CONTROL ESCAPE - 20 1
SET CONTROL MSC DTE 00 00 00 00 00 00
SET PROFILE HFP WT12 Hands Free
SET PROFILE SPP Bluetooth Serial Port
SET

Example of binding PIO5 to close connection and delete all pairings after PIO5 has
fallen. SET command shows that the binding of commands was succesfull.

6.22 SET CONTROL MSC

With iWRAP firmware it's possible to transmit all the UART modem signals over the SPP (Serial Port Profile) Bluetooth link. The signals DSR, DTR, RTS, CTS, RI and DCD can be specified to PIO2-PIO7 on the WT12/WT11 and 2022-1 modules.

6.22.1 Syntax

Synopsis:
SET CONTROL MSC [[*mode*] [[*DSR*] [[*DTR*] [[*RTS*] [[*CTS*] [[*RI*] [*DCD*]]]]]]]

Description:	
mode	Mode of the device iWRAP connects to. The mode can be: **DTE** or **DCE** **NOTE:** DTE means that remote Bluetooth device is DTE (so iWRAP is DCE and device connected to iWRAP is DTE.
DSR	Data Set Ready. Select PIO with a bitmask. See Note below how to select the PIO.
DTR	Data Terminal Ready. See Note below how to select the PIO.
RTS	Request To Send. See Note below how to select the PIO.
CTS	Clear To Send. See Note below how to select the PIO.
RI	Ring Indicator. See Note below how to select the PIO.
DCD	Data Carrier Detect. See Note below how to select the PIO.

NOTE:

PIO pin is selected with a bit mask. For example, if you want to use PIO3, you will then have a bit mask where the third bit is 1, ie 1000. This bit mask value is then given in the command in hexadecimal format. 1000(bin) = 8(hex).

Events:	
SYNTAX ERROR	This event occurs if incorrect parameters are given.

6.22.2 Examples

Setting UART signals to iWRAP. IWRAP is set to DCE mode, DSR signal is set to PIO2, DTR to PIO3 and DCD to PIO4.

SET CONTROL MSC DCE 4 8 0 0 0 10

Giving the MSC command with out parameters outputs the synopsis.

SET CONTROL MSC
SET CONTROL MSC [[mode] [[DSR] [[DTR] [[RTS] [[CTS] [[RI] [DCD]]]]]]]

Disabling MSC:

SET CONTROL MSC
SET CONTROL MSC DTE 0 0 0 0 0 0

7. SET {LINK_ID}

In the following chapters all commands related to '**SET {link_id}**' are described. In general with these commands different parameters related to active Bluetooth connections can be modified, such as power saving, master-slave modes etc.

7.1 SET {link_id} ACTIVE

This command disables all the power save modes for the defined, active Bluetooth link and sets it into an active mode.

7.1.1 Syntax

Synopsis:
SET {*link_id*} ACTIVE

Description:	
link_id	Numeric connection identifier

Events:
None

7.1.2 Examples

Changing from SNIFF to active:

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING SNIFF
MASTER PLAIN
SET 0 ACTIVE
LIST
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
```

7.2 SET {link_id} MASTER

Tries to switch the link to Piconet master. Notice that this may not be allowed by the remote end.

7.2.1 Syntax

Synopsis:
SET {*link_id*} MASTER

Description:	
link_id	Numeric connection identifier

Events:
None

7.2.2 Examples

Changing from slave to master:

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
SLAVE PLAIN
SET 0 MASTER
LIST
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
```

7.3 SET {link_id} SLAVE

Tries to switch the link to Piconet slave. Notice that this may not be allowed by the remote end.

7.3.1 Syntax

Synopsis:
SET {*link_id*} SLAVE

Description:	
link_id	Numeric connection identifier

Events:
None

7.4 SET {link_id} PARK

This command tries to enable the PARK mode for the defined Bluetooth link. Whether this command is successful or not depends if the remote end allows park state to be used.

7.4.1 Syntax

Synopsis:
SET {*link_id*} PARK {max}{min} or **SET {*link_id*} PARK {avg}**

Description:	
link_id	Numeric connection identifier
max	Maximum acceptable interval
mix	Maximum acceptable interval
avg	Shortcut for easier park setting

Events:
None

7.4.2 Examples

Changing from active to PARK:

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
SET 0 PARK 1000
LIST
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING PARK
MASTER PLAIN
```

Note:

Refer to Bluetooth specification for more information about park state and its usage.

7.5 SET {link_id} SNIFF

This command tries to enable the SNIFF mode for the defined Bluetooth link. Whether this command is successful or not depends if the remote end allows sniff to be used.

7.5.1 Syntax

Synopsis:
SET {*link_id*} SNIFF {max}{min} [{attempt} {timeout}] or **SET {*link_id*} SNIFF {avg}**

Description:	
link_id	Numeric connection identifier
max	Maximum acceptable interval in milliseconds
mix	Maximum acceptable interval in milliseconds
avg	Average value is milliseconds. Shortcut for easier sniff setting.
attempt	Number of SNIFF attempts (default value 1)
timeout	SNIFF timeout (default value 8)

Events:
None

Note:

Refer to Bluetooth specification for more information.

7.6 SET {link} MSC

With this command it is possible to send 07.10 Modem Status Command to the remote device without having the signals actually connected to the module.

7.6.1 Syntax

Synopsis:
SET {*link_id*} MSC {*status*}

Description:	
link_id	Numeric connection identifier of the link where the modem status is to be sent.
status	Status of the signals according to 07.10 standard.

Response:
No response

7.6.2 Examples

Example usage of sending MSC:

SET 0 MSC 8D
Normal MSC status was sent.

7.7 TESTMODE

Command **TESTMODE** enables Bluetooth Test Mode in which Bluetooth Testers may be used to test radio environment.

7.7.1 Syntax

Synopsis:
TESTMODE

Description:
None

Response:
TEST 0

Events:
None

7.8 BER {link_id}

BER command returns the Bit Error Rate of the link givens as a parameter.

7.8.1 Syntax

Synopsis:
BER { *link_id*}

Description:	
link_id	Numeric connection identifier

Response:	
BER { *bd_addr*} { *ber*}	
bd_addr	Bluetooth address of the remote device
ber	Average Bit Error Rate in the link. Possible values from 0.0000 to 100.0000.

Events:
None

7.8.2 Examples

Checking the Bit Error Rate of an active connection

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
BER 0
BER 00:60:57:a6:56:49 0.0103
```

Note:

Works only for BDR links.

7.9 RSSI {link_id}

RSSI command returns the Receiver Signal Strength Indication of the link givens as a parameter.

7.9.1 Syntax

Synopsis:
RSSI {*link_id*}

Description:	
link_id	Numeric connection identifier

Response:	
RSSI {*bd_addr*} {*rssi*}	
bd_addr	Bluetooth address of the remote device
rssi	Receiver Signal Strength Indication. Possible values from +20 to -128. 20 = Good link -128 = poor link

Events:
None

7.9.2 Examples

Checking the Bit Error Rate of an active connection:

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
RSSI 0
BER 00:60:57:a6:56:49 -10
```

7.10 TXPOWER

TXPOWER command can be used check the TX output power level of an active Bluetooth link.

7.10.1 Syntax

Synopsis:
TXPOWER { *link_id* **}**

Description:	
link_id	Numeric connection identifier

Response:	
TXPOWER { *bd_addr* **} {** *txpower* **}**	
bd_addr	Bluetooth address of the remote device
txpower	User TX power level in dBm

Events:
None

7.10.2 Examples

Checking the TX power level of an active connection:

```
LIST
LIST 1
LIST 0 CONNECTED RFCOMM 320 0 0 3 8d 8d 00:60:57:a6:56:49 1 OUTGOING ACTIVE
MASTER PLAIN
TXPOWER 0
TXPOWER 00:60:57:a6:56:49 3
```

7.11 SDP

SDP command can be used to browse the available services on other Bluetooth devices.

7.11.1 Syntax

Synopsis:
SDP {*bd_addr*} {*uuid*}

Description:	
bd_addr	Bluetooth address of the remote device
uuid	Service to look for UUID "1002" stands for root and returns all the services remote device supports.

Response:	
SDP {*bd_addr*} < I SERVICENAME S "service_*name*" > < I PROTOCOLDESCRIPTORLIST < < U L2CAP > < U RFCOMM I channel > > > ***SDP***	
bd_addr	Bluetooth address of the remote device
service name	Name of the service. For example "Serial Port Profile"
channel	RFCOMM channel for the service

Events:
None

7.11.2 Examples

How to look for SPP service:

```
SDP 00:07:80:80:52:15 1101
SDP 00:07:80:80:52:15 < I SERVICENAME S "Bluetooth Serial Port" > < I PROTOCOLDE
SCRIPTORLIST < < U L2CAP > < U RFCOMM I 01 > > >
```

SDP

7.12 SDP ADD

SDP add command can be used to modify local service record to add new services.

7.12.1 Syntax

Synopsis:
SDP ADD {*uuid***} {***name***}**

Description:	
uuid	Identifier of the service
name	Name of the service

Response:	
SDP {*channel***}**	
channel	RFCOMM channel where the service is bound to

Events:
None

7.12.2 Examples

Adding Dial-Up Networking profile

SDP ADD 1103 Dial-Up Networking
SDP 2

Note:

Service record will be cleared when reset is made, so SDP ADD command(s) need to be given every time after reset unlike SET commands, which are stored on flash memory.

"SET CONTROL INIT" can be used to automatically issue one "SDP ADD" command.

7.13 SLEEP

SLEEP command will force deep sleep on. After issuing this command the module will enter deep sleep until a Bluetooth connection is received or something is received from UART interface in command mode. SLEEP command will also work when there are one or more active connections and iWRAP is in command mode.

Deep sleep is an aggressive power saving mode for LinkMatik 2 modules.

7.13.1 Syntax

Synopsis:
SLEEP

Description:
None.

Response:
None

Events:
None

Note:

Refer to current consumption documents for more information about current consumption in deep sleep mode.

7.14 SCO ENABLE

SCO ENABLE command is needed before any SCO (audio) connections can be used

7.14.1 Syntax

Synopsis:
SCO ENABLE

Description:
None

Response:
None

Events:
None

Note:

SCO ENABLE command needs to be given every time after reset, it 's not stored on flash memory.

"SET CONTROL INIT" can be used to automatically issue one "SCO ENABLE" command.

7.15 SCO OPEN

SCO OPEN command is used to open the actual SCO connection. An existing RFCOMM connection is needed before SCO OPEN can be issued.

7.15.1 Syntax

Synopsis:
SCO OPEN { *link_id***}**

Description:	
link_id	Numeric connection identifier

Response:
None

Response:
None

Events:	
CONNECT	If SCO connection was opened successfully
NO_CARRIER	If connection opening failed

Note:

SCO ENABLE command need to be given before SCO OPEN command can be used.

7.15.2 Examples

Creating SCO connection to other iWRAP device:

```
SCO ENABLE
CALL 00:07:80:80:52:27 1 RFCOMM
CALL 0
CONNECT 0 RFCOMM 1
[+++]
SCO OPEN 0
CONNECT 1 SCO
```

7.16 BOOT

BOOT command used to change the settings of a module. After issuing this command, the module will enter the selected mode. The modes can be seen from chapter 8.3. After resetting the module, it will boot in iWRAP mode again.

7.16.1 Syntax

Synopsis:
BOOT [boot_mode]

Description:	
boot_mode	**0000** iWRAP **0001** HCI, BCSP, 115800,8n1 **0003** HCI, USB **0004** HCI, H4, 115200,8n1

Response:
No response

7.16.2 Examples

BOOT 1
Ò ¯WWUo`À           Ò  ¯WWUo`À   Ò ¯WWUo`À                     Ò  ¯WWUo`À   Ò ¯WWUo `À *Example of changing the module to HCI BCSP 115200 with the BOOT command. After resetting the module, iWRAP becomes active.*

7.17 ECHO

ECHO command sends a specified string of characters into active link specified by 'link_id' parameter. This command can be used for example with command SET CONTROL BIND to send indication of activity over Bluetooth link.

7.17.1 Syntax

Synopsis:
ECHO {*link_id*} [*string*]

Description:	
link_id	Numeric connection identifier
string	User determined string of characters If **"%p"** is used as a value iWRAP will echo the status of local GPIO pins

Response:
No response

Events:
None

7.17.2 Examples

ECHO 0 WT12_DATA_1 *On the other device UART receive:* WT12_DATA_1

7.18 PING {link_id}

PING command sends a Bluetooth test packet into the other device, which sends the packet back and the round trip time of the packet is shown.

7.18.1 Syntax

Synopsis:
PING {*link_id*}

Description:	
link_id	Numeric connection identifier

Response:	
RSSI {*bd_addr*} {*round trip time*}	
bd_addr	Bluetooth address of the remote device
Round trip time	Round trip time of the packet.

Events:
None

7.18.2 Examples

Checking the round trip time:

```
PING 0
PING 00:07:80:80:c3:4a 42
```

Round trip time is 42ms in this case.

7.19 TEST

TEST command is used to give radio test commands to iWRAP. The commands are the same that can be given using CSR BlueTest software (downloadable from www.bluegiga.com/techforum). From Performance Measurement Guide you can see how the radio tests are intended to be used.

7.19.1 Syntax

Synopsis:
TEST {*mode***} [***mode_specific_parameters***]**

Description:

mode &	RF Test mode
mode_specific_parameters	Supported test modes are:
	PAUSE
	Pause halts the current test and stops any radio activity.
	TXSTART {lo_freq} {level} {mod_freq}
	Enables the transmitter in continuous transmission at a designated frequency (**lo_freq**) with a designated output power (**level**) and designated tone modulation frequency (**mod_freq**).
	lo_freq range: 2402 – 2480 (MHz)
	level range: 0 – 63
	mod_freq range: 0 – 32767 (recommended values 0 or 256)
	TXDATA1 {lo_freq} {level}
	Enables the transmitter with a designated frequency (**lo_freq**) and output power (**level)**. Payload is PRBS9 data. In this mode the receiver is not operating.
	TXDATA2 {cc} {level}
	Enables the transmitter with a simplified hop sequence designated by country code **{cc}** and output power **{level}**. Payload is PRBS9 data. In this mode the receiver is not operating.
	Related test spec name: **TRM/CA/01/C** (output

power), **TRM/CA/02/C** (power density).

cc range: 0 – 3 (default = 0)

RXSTART {lo_freq} {highside} {attn}

Enables the receiver in continuous reception at a designated frequency (**lo_freq**) with a choice of low or high side modulation (**highside**) and with designated attenuation setting (**attn**).

highside range: 0 or 1 (default = false = 0)

attn: range: 0 – 15

DEEPSLEEP

Puts the module into deep-sleep after delay of half a second until woken by reset or activity on UART.

PCMLB {pcm_mode}

Sets the PCM into loop back mode, where the data read from PCM input is output again on the PCM output.

If **pcm_mode** = 0, module is slave in normal 4-wire configuration

If **pcm_mode** = 1, module is master in normal 4-wire configuration

If **pcm_mode** = 2, module is master in Manchester encoded 2-wire configuration

PCMEXTLB {pcm_mode}

Sets the PCM into external loop back mode, whereby the data written to PCM output is read again on the input. Check is made that the data read back is the same as that written.

The external loop back may be a simple wire.

LOOPBACK {lo_freq} {level}

Receives data on set frequency **lo_freq** for data packets and then retransmits this data on the same channel at output power **level**.

CFGXTALFTRIM {xtal_ftrim}

This command can be used to set the crystal frequency trim value directly from iWRAP. This is not a permanent setting!

xtal_ftrim range: 0 – 63

	PCMTONE {freq} {ampl} {dc} Plays constant tone on the PCM port. **freq** range: 0 – 5 **ampl** range : 0-8 **dc**: 0 – 60096 (set to 0) **SETPIO {mask} {bits}** Sets PIO high or low according to given parameters. NOTE: This command sets the PIO regardless of other usage! **mask**: Bit mask which specifies which PIO's are to be set **bits**: the bit values If you use hexadecimals, put 0x before the value, otherwise they are interpreted as decimals. **GETPIO** Get's the status of all the PIO lines.

Response:
OK for successful execution **ERROR** for unsuccessful execution

7.19.2 Examples

TEST TXSTART 2441 63 0
OK

Example on how to set the module to transmit continuous carrier signal at 2441MHz and at full output power.

TEST PCMTONE 1 5 0
OK

Example on how to set the modules PCM output a constant signal for PCM testing.

8. IWRAP EVENTS

Events are mechanism that iWRAP uses to notify the user for completed commands, incoming connections, etc.

If iWRAP is in data mode (data is being transmitted and no multiplexing mode used) the only possible event is **<u>NO CARRIER</u>** indicating that connection was closed or lost.

Note:

- iWRAP is designed so that unwanted events can be safely ignored. Events **<u>CONNECT</u>**, **<u>NO CARRIER</u>** and **<u>RING</u>** change the mode of operation and therefore they cannot be ignored.

- Events may be masked away by removing **Bit 2** on command **SET CONTROL ECHO**.

8.1 CONNECT

CONNECT event is used to notify for successful link establishment.

8.1.1 Syntax

Synopsis:
CONNECT {*link_id*} {SCO	RFCOMM {*channel*} [*address*]}

Description:	
link_id	Numeric connection identifier
channel	Connected RFCOMM channel number
address	Address of the remote end. This is displayed only if bit 5 is set in "**SET CONTROL CONFIG**".

Note:

iWRAP automatically goes into data mode after CONNECT event if multiplexing mode is disabled.

8.2 <u>INQUIRY_PARTIAL</u>

INQUIRY_PARTIAL event is used to notify found Bluetooth device. This event precedes response for **INQUIRY** command.

8.2.1 Syntax

Synopsis:
INQUIRY_PARTIAL {*address***} {***class_of_device***} [{***cahced_name***} {***rssi***}]**

Description:	
address	Bluetooth address of found device
class_of_device	C Bluetooth Class of Device of found device
cached_name	User friendly name of found device if already known
rssi*	Received Signal Strength of found device

*) RSSI is a value between -128 and 0. Lower the value, lower the signal strength.

Note:

- *cached_name* and *rssi* are only visible if "Inquiry with RSSI" is enabled with "**SET CONTROL CONFIG**".

8.3 <u>NO CARRIER</u>

NO CARRIER event is used to notify for link loss or alternatively failure in link establishment.

8.3.1 Syntax

Synopsis:
NO CARRIER {*link_id*} RFCOMM {*error_code*} [*message*]

Description:	
link_id	Numeric connection identifier
error_code	Code describing the error
message	Optional verbose error message

8.4 <u>READY</u>

READY event is used to notify for switching to command mode or to indicate that iWRAP is ready to be used after reset or after a successful switch between normal or multiplexing mode has been done.

8.4.1 Syntax

Synopsis:
READY.

Description:
None

8.5 <u>NAME</u>

<u>NAME</u> event is used to notify for successful lookup for Bluetooth friendly name of the remote device.

8.5.1 Syntax

Synopsis:
NAME { *address* **} {** *"friendly_name"* **}**

Description:	
address	Bluetooth device address of the device
friendly_name	Friendly name of the device

8.6 NAME ERROR

NAME ERROR event is used to notify for Bluetooth friendly name lookup failure.

8.6.1 Syntax

Synopsis:
NAME ERROR {*error_code*} {*address*} [*message*]

Description:	
error_code	Code describing the error
address	Bluetooth address of the device
message	Optional verbose error message

8.7 PAIR

PAIR event is used to notify a successful pairing.

8.7.1 Syntax

Synopsis:
PAIR {*address***} {***key_type***} {***link_key***}**

Description:	
address	Bluetooth device address of the paired device

key_type	Type of link key
	
	0
	
	      Combination key
	
	1
	
	      Local unit key
	
	2
	
	      Remote unit key
	
	ff
	
	      Unknown key

link_key	Link key shared between the local and the paired device

Note:

PAIR event is enabled or disabled with "**SET CONTROL CONFIG**".

If **PAIR** event is enabled and pairing is done, the event will also be shown during **CALL** procedure and also before **RING** event.

8.8 RING

RING event is used to notify for incoming connection. Incoming connections are accepted only if there is no existing links.

8.8.1 Syntax

Synopsis:
RING {*link_id***} {***address***} {SCO	{***channel***} RFCOMM}**

Description:	
link_id	Numeric connection identifier
address	Bluetooth device address of the device
channel	Local RFCOMM or SCO channel

8.9 SYNTAX ERROR

SYNTAX ERROR is not an actual event but error message describing faulty typed command or error in command parameters.

8.9.1 Syntax

Synopsis:
SYNTAX ERROR

9. IWRAP ERROR MESSAGES

This chapter briefly presents the iWRAP's error messages.

9.1 HCI errors

HCI errors start with code: ***0x100***

ERROR MESSAGE	CODE
HCI_SUCCESS	0x00
HCI_ERROR_ILLEGAL_COMMAND	0x01
HCI_ERROR_NO_CONNECTION	0x02
HCI_ERROR_HARDWARE_FAIL	0x03
HCI_ERROR_PAGE_TIMEOUT	0x04
HCI_ERROR_AUTH_FAIL	0x05
HCI_ERROR_KEY_MISSING	0x06
HCI_ERROR_MEMORY_FULL	0x07
HCI_ERROR_CONN_TIMEOUT	0x08
HCI_ERROR_MAX_NR_OF_CONNS	0x09
HCI_ERROR_MAX_NR_OF_SCO	0x0a
HCI_ERROR_MAX_NR_OF_ACL	0x0b
HCI_ERROR_COMMAND_DISALLOWED	0x0c
HCI_ERROR_REJ_BY_REMOTE_NO_RES	0x0d
HCI_ERROR_REJ_BY_REMOTE_SEC	0x0e
HCI_ERROR_REJ_BY_REMOTE_PERS	0x0f
HCI_ERROR_HOST_TIMEOUT	0x10
HCI_ERROR_UNSUPPORTED_FEATURE	0x11
HCI_ERROR_ILLEGAL_FORMAT	0x12

HCI_ERROR_OETC_USER	0x13
HCI_ERROR_OETC_LOW_RESOURCE	0x14
HCI_ERROR_OETC_POWERING_OFF	0x15
HCI_ERROR_CONN_TERM_LOCAL_HOST	0x16
HCI_ERROR_AUTH_REPEATED	0x17
HCI_ERROR_PAIRING_NOT_ALLOWED	0x18
HCI_ERROR_UNKNOWN_LMP_PDU	0x19
HCI_ERROR_UNSUPPORTED_REM_FEATURE	0x1a
HCI_ERROR_SCO_OFFSET_REJECTED	0x1b
HCI_ERROR_SCO_INTERVAL_REJECTED	0x1c
HCI_ERROR_SCO_AIR_MODE_REJECTED	0x1d
HCI_ERROR_INVALID_LMP_PARAMETERS	0x1e
HCI_ERROR_UNSPECIFIED	0x1f
HCI_ERROR_UNSUPP_LMP_PARAM	0x20
HCI_ERROR_ROLE_CHANGE_NOT_ALLOWED	0x21
HCI_ERROR_LMP_RESPONSE_TIMEOUT	0x22
HCI_ERROR_LMP_TRANSACTION_COLLISION	0x23
HCI_ERROR_LMP_PDU_NOT_ALLOWED	0x24
HCI_ERROR_ENC_MODE_NOT_ACCEPTABLE	0x25
HCI_ERROR_UNIT_KEY_USED	0x26
HCI_ERROR_QOS_NOT_SUPPORTED	0x27
HCI_ERROR_INSTANT_PASSED	0x28
HCI_ERROR_PAIR_UNIT_KEY_NO_SUPPORT	0x29

HCI_ERROR_CHANNEL_CLASS_NO_SUPPORT	0x2e

Table 5: HCI errors

9.2 SDP errors

SDP errors start with code: **_0x300_**

ERROR MESSAGE	CODE
SDC_OK	0x00
SDC_OPEN_SEARCH_BUSY	0x01
SDC_OPEN_SEARCH_FAILED	0x02
SDC_OPEN_SEARCH_OPEN	0x03
SDC_OPEN_DISCONNECTED	0x04
SDC_NO_RESPONSE_DATA	0x11
SDC_ERROR_RESPONSE_PDU	0x10
SDC_CON_DISCONNECTED	0x12
SDC_CONNECTION_ERROR	0x13
SDC_CONFIGURE_ERROR	0x14
SDC_SEARCH_DATA_ERROR	0x15
SDC_DATA_CFM_ERROR	0x16
SDC_SEARCH_BUSY	0x17
SDC_RESPONSE_PDU_HEADER_ERROR	0x18
SDC_RESPONSE_PDU_SIZE_ERROR	0x19
SDC_RESPONSE_TIMEOUT_ERROR	0x1a
SDC_SEARCH_SIZE_TOO_BIG	0x1b
SDC_RESPONSE_OUT_OF_MEMORY	0x1c

SDC_RESPONSE_TERMINATED	0x1d

Table 6: SDP errors

9.3 RFCOMM errors

RFCOMM errors start with code: *0x400*

ERROR MESSAGE	CODE
RFC_OK	0x00
RFC_CONNECTION_PENDING	0x01
RFC_CONNECTION_REJ_PSM	0x02
RFC_CONNECTION_REJ_SECURITY	0x03
RFC_CONNECTION_REJ_RESOURCES	0x04
RFC_CONNECTION_REJ_NOT_READY	0x05
RFC_CONNECTION_FAILED	0x06
RFC_CONNECTION_TIMEOUT	0x07
RFC_NORMAL_DISCONNECT	0x08
RFC_ABNORMAL_DISCONNECT	0x09
RFC_CONFIG_UNACCEPTABLE	0x0a
RFC_CONFIG_REJECTED	0x0b
RFC_CONFIG_INVALID_CID	0x0c
RFC_CONFIG_UNKNOWN	0x0d
RFC_CONFIG_REJECTED_LOCALLY	0x0e
RFC_CONFIG_TIMEOUT	0x0f
RFC_REMOTE_REFUSAL	0x11
RFC_RACE_CONDITION_DETECTED	0x12
RFC_INSUFFICIENT_RESOURCES	0x13
RFC_CANNOT_CHANGE_FLOW_CONTROL_MECHANISM	0x14

RFC_DLC_ALREADY_EXISTS	0x15
RFC_DLC_REJ_SECURITY	0x16
RFC_GENERIC_REFUSAL	0x1f
RFC_UNEXPECTED_PRIMITIVE	0x20
RFC_INVALID_SERVER_CHANNEL	0x21
RFC_UNKNOWN_MUX_ID	0x22
RFC_LOCAL_ENTITY_TERMINATED_CONNECTION	0x23
RFC_UNKNOWN_PRIMITIVE	0x24
RFC_MAX_PAYLOAD_EXCEEDED	0x25
RFC_INCONSISTENT_PARAMETERS	0x26
RFC_INSUFFICIENT_CREDITS	0x27
RFC_CREDIT_FLOW_CONTROL_PROTOCOL_VIOLATION	0x28
RFC_RES_ACK_TIMEOUT	0x30

Table 7: RFCOMM errors

10. USEFULL INFORMATION

This chapter contains some useful information about iWRAP and LinkMatik 2 module usage.

10.1 Changing parameters over RS232 with PSTool

PSTool software allows the user to change the internal parameters (PS-keys) of the module. Most of the parameters should not be touched, since they may affect the performance of the module, but on the other hand there are some useful parameters, which can not be accessed from iWRAP such as: hardware flow control, host interface parameters etc.

Notice that although the parameters can be easily changed over the UART interface, incorrect configuration may prevent iWRAP from working and block any further but SPI communications with the module.

iWRAP has a useful feature called AutoBCSP. This means that iWRAP automatically recognizes BCSP (BlueCore Serial Protocol) traffic and is able to interpret it. BCSP can be used to change the internal parameters and is supported also by the PSTool software.

To change the internal parameters, do the following:

1. Connect RS2323 cable between the LinkMatik 2 and your PC

2. Power up the LinkMatik 2 module

3. Open PSTool

4. Use connection settings (default): **BCSP**, **COMn** and **115200**

5. Change the needed parameters (Remember to press 'SET' after changing the parameter value)

6. Close PSTool and reset LinkMatik.

iWRAP is activated automatically after reset, unless parameters affecting iWRAP operation are changed.

NOTE:

*) UART baud rate when using BCSP is NOT dependent on the "SET CONTROL BAUD" configuration, but on the other hand is defined by PS-key "PSKEY_UART_BAUD RATE". By default the parameter is 115200 bps.

AutoBCSP feature works only if PSKEY_UART_BAUD_RATE and "SET CONTROL BAUD" have same values!

Refer to *PSTool User Guide* for more information about PS-keys and PSTool usage.

PSTool can be also used via SPI interface. A cable called *Onboard Installation Kit* is needed.

10.2 Using BlueTest over RS232

BlueTest is a piece of software which can be used to do several built-in radio tests, like Bit Error Rate (BER) measurements, TX power measurements and RX measurements. BlueTest also uses BCSP protocol to talk to the module and can be used in a similar way than PSTool.

To use BlueTest:

1. Connect RS2323 cable between the LinkMatik 2 and your PC

2. Power up the LinkMatik 2 module

3. Open BlueTest

4. Use connection settings (default): **BCSP**, **COMn** and **115200**

5. Do necessary tests

6. Close BlueTest and reset LinkMatik 2.

10.3 Switching to HCI firmware

New LinkMatik 2 firmware builds are called *unified firmware (*firmware versions 18.2 and later*).* This means the firmware contains both iWRAP firmware and RFCOMM and HCI stacks. The selection which part is active is done with PS-keys and there is no need to reflash the actual firmware as with older versions of iWRAP.

Switching can be done easily using PSTool software.

1. Connect the LinkMatik 2 module as instructed in chapter 8.1.

2. Change following parameters to switch to HCI mode

      a. PSKEY_INITIAL_BOOTMODE

            i. 0000 = iWRAP

            ii. 0001 = HCI, BCSP, 115800,8n1

            iii. 0003 = HCI, USB

            iv. 0004 = HCI, H4, 115200,8n1

      b. PSKEY_UART_BAUDRATE   (Suitable value if H4 or BCSP used)

      c. PSKEY_UART_CONFIG_H4
         PSKEY_UART_CONFIG_BCSP   (Suitable key/value)

      d. PSKEY_USB_XXXX   (If USB used, configure necessary keys)

Note:

PSTool 1.21 or later is needed to change the parameters mentioned above.

10.4 Firmware updates over SPI

SPI interface is dedicated to firmware updates. Onboard Installation Kit and a Windows™ software called BlueFlash software can be used to update / restore the firmware. Please see BlueFlash user guide for more information.

Bluegiga also has a tool called iWRAP update client, which is an easier and suggested way to do the firmware upgrade. iWRAP update client can recognize the hardware and software version of the module and reflash correct firmware and parameters into the module, and the user just needs the select the firmware version. Please refer to iWRAP update user guide for more information.

10.5 Firmware updates over UART

The firmware can also be updated over UART or RS232 interface. A method called Device Firmware Upgrade (DFU) is needed. Bluegiga has a DFU Wizard tool, which allows the updates to be made from a Windows™ based PC is a similar way as with BlueFlash.

There is also a possibility the write the DFU support into a host processor connected to the LinkMatik 2 module. In this way the firmware can be updated even if the module can not be accessed from a PC.

DFU protocol is open and the description be requested from Bluegiga's support.

DFU file sizes:

- iWRAP update: ~20-30kB

- Bluetooth stack update: ~700kB

- Full update (max DFU sie): ~1MB

10.6 Hardware Flow Control

Hardware flow control is enabled by default. It can be disabled by changing the value of PSKEY_UART_CONFIG_XXX (XXX = USR or H4 or H5 or BCSP). With iWRAP the PS-key is PSKEY_UART_CONFIG_USR.

- If PSKEY_UART_CONFIG_USR is **08a8**, HW flow control is enabled

- If PSKEY_UART_CONFIG_USR is **08a0**, HW flow control is disabled

Hardware flow control can be disabled also with a proper hardware design. If the flow control parameter is enabled, but no flow control is used. The following steps should be implemented in the hardware design:

- WT12 CTS pin must be grounded

- WT12 RTS pin must be left floating

WARNING:

If HW flow control is disabled and iWRAP buffers are filled (in command or data mode) the firmware will hang and needs a physical reset to survive. So there fore HW flow control should be used when ever possible to avoid this situation.

However if HW flow control needs to be disabled the host system should designed in a way that it is able to recognize that the firmware has hanged and is able to survive it.

10.7 PS-keys used by iWRAP firmware

TBA

10.8 Bluetooth profiles overview

10.8.1 Generic Access Profile (GAP)

GAP provides the basis for all other profiles and defines a consistent means to establish a baseband link between *Bluetooth* enabled devices. In addition to this, GAP defines the following:

- The features must be implemented in all *Bluetooth* devices

- Generic procedures for discovering and linking to devices

- Basic user-interface terminology

10.8.2 RFCOMM

The RFCOMM protocol emulates the serial cable line settings and status of an RS-232 serial port and is used for providing serial data transfer. RFCOMM connects to the lower layers of the *Bluetooth* protocol stack through the L2CAP layer. By providing serial-port emulation, RFCOMM supports legacy serial-port applications while also supporting the OBEX protocol among others. RFCOMM is a subset of the ETSI TS 07.10 standard, along with some *Bluetooth*-specific adaptations.

10.8.3 Service Discovery Protocol (SDP)

SDP defines how a *Bluetooth* client application acts to discover an available *Bluetooth* enabled server services and characteristics. SDP provides means for the discovery of new services becoming available when the client enters an area where a *Bluetooth* enabled server is operating. SDP also provides functionality for detecting when a service is no longer available. SDP defines a service as any feature that is usable by another *Bluetooth* device. A single *Bluetooth* enabled device can be both a server and a client of services. An SDP client communicates with an SDP server using a reserved channel on an L2CAP link to find out what services are available. When the client finds the desired service, it requests a separate connection to use the service. The reserved channel is dedicated to SDP communication so that a device always knows how to connect to the SDP service on any other device. An SDP server maintains its own SDP database, which is a set of service records that describe the services the server offers. Along with information describing how a client can connect to the service, the service record contains the service's UUID, or universally unique identifier.

10.8.4 Serial Port Profile (SPP)

SPP defines how to set-up virtual serial ports and connect two *Bluetooth* enabled devices. SPP is based on the ETSI TS07.10 specification and uses the RFCOMM protocol to provide serial-port emulation. SPP provides a wireless replacement for existing RS-232 based serial communications applications and control signals. SPP provides the basis for the DUN, FAX, HSP and LAN profiles. This profile supports a data rate of up to 128 kbit/sec. SPP is dependent on GAP.

10.8.5 Hands-Free profile (HFP)

HFP describes how a gateway device can be used to place and receive calls for a hand-free device. A typical configuration is an automobile using a mobile phone for a gateway device. In the car, the stereo is used for the phone audio and a microphone is installed in the car for sending outgoing audio. HFP is also used for a personal computer to act as a speakerphone for a mobile phone in a home or office environment. HFP uses SCO to carry a mono, PCM audio channel.

10.8.6 Dial-up Networking Profile (DUN)

DUN provides a standard to access the Internet and other dial-up services over *Bluetooth* technology. The most common scenario is accessing the Internet from a laptop by dialing up on a mobile phone wirelessly. It is based on SPP and provides for relatively easy conversion of existing products, through the many features that it has in common with the existing wired serial protocols for the same task. These include the AT command set specified in ETSI 07.07 and PPP.

Like other profiles built on top of SPP, the virtual serial link created by the lower layers of the *Bluetooth* protocol stack is transparent to applications using the DUN profile. Thus, the modem driver on the data-terminal device is unaware that it is communicating over *Bluetooth* technology. The application on the data-terminal device is similarly unaware that it is not connected to the gateway device by a cable.

DUN describes two roles, the gateway and terminal devices. The gateway device provides network access for the terminal device. A typical configuration consists of a mobile phone acting as the gateway device for a personal computer acting as the terminal role.

10.8.7 Object Push Profile (OPP)

OPP defines the roles of push server and push client. These roles are analogous to and must interoperate with the server and client device roles that GOEP defines. It is called push because the transfers are always instigated by the sender (client), not the receiver (server). OPP focuses on a narrow range of object formats to maximize interoperability. The most common acceptable format is the vCard. OPP may also be used for sending objects such as pictures or appointment details.

Source:

Bluetooth SIG, URL:
http://www.bluetooth.com/Bluetooth/Learn/Works/Profiles_Overview.htm

10.9 Bluetooth Power Saving

SNIFF mode:

Once a Bluetooth device is connected to a Piconet, it can enter one of three power saving modes. In SNIFF mode the activity of a Bluetooth devise is lowered, enabling it to listen at a reduced rate to the Piconet. The interval or period between SNIFF is configurable.

SNIFF mode is the least power efficient of all three power saving modes.

PARK state:

The Park state can be used when a Bluetooth device is connected to the Piconet but does not participate in traffic transfer.

The Park mode conserves the most power compared with other power saving modes.

General information about power saving:

On the SNIFF mode and on the PARK state, the devices have a reduced participation on the traffic of messages and packets. On the SNIFF mode this occurs only at 'SNIFF intervals' and at the PARK state at the beacons (at this mode the device also listens to broadcast messages).

The main advantage for using PARK mode over SNIFF mode is that it leads to reduced power consumption and gives more time for the parked slave to participate on different Piconet(s).

10.10 UUIDs of different Bluetooth profiles

UUID:	Bluetooth Profile:
0001	SDP
0003	RFCOMM
0008	OBEX
000C	HTTP
0100	L2CAP
000F	BNEP
1000	Service Discovery Server Service ClassID
1001	Browse Group Descriptor Service ClassID
1002	Public Browse Group
1101	Serial Port Profile
1102	LAN Access Using PPP
1103	Dial up Networking
1104	IrMC Sync
1105	OBEX Object Push Profile
1106	OBEX File Transfer Profile
1107	IrMC Sync Command
1108	Headset
1109	Cordless Telephony
110A	Audio Source
1111	Fax
1112	Headset Audio Gateway
1115	Personal Area Networking User
1116	Network Access Point
1117	Group Network
111E	Hands free
111F	Hands free Audio Gateway

1201	Generic Networking
1202	Generic File Transfer
1203	Generic Audio
1204	Generic Telephony

Table 8: UUIDs and Profiles

11. TROUBLESHOOTING

11.1 I get no response from iWRAP?

Make sure your terminal settings are correct. Use **PSTool** to check the UART settings from the LinkMatik 2 Bluetooth module and make similar settings into your terminal software.

Check also your ECHO MODE settings. If you have set ECHO MODE to 0, you should not be able to see any responses.

You can also use iWRAP update to restore the firmware and default settings.

11.2 I changed 'UART Baud rate' key, but it didn't seem to work?

UART baud rate is stored now into user keys instead of '**UART baud rate'** key. Delete '**User configuration data 26**' in order to return back to default settings **115200,8n1**.

Notice also that if you change baud rate with "SET CONTROL BAUD" it does not affect the baud rate you need to use with PSTool, if you want to access parameters. This baud rate is defined by the **'UART baud rate'** key.

AutoBCSP requires that iWRAP baud rate is same as '**UART baud rate**' key.

11.3 Data coming form the UART is corrupted

If you are using 'Deep sleep' the minimum baud rate that can be used is 19200. Lower baud rates will corrupt the data.

11.4 I'm missing characters when I type ASCII commands.

If deep sleep is used first character written to UART wakes the module from the 'Deep sleep' and that's why the character is lost. There are two ways to overcome this problem:

1. If you command iWRAP with a micro controller or processor add 'space' or 'line break' characters in front of every command.

2. In PSTool set parameter 'EXIT deep sleep on CTS line activity' to TRUE. Now 'Deep sleep' does not lose characters any more, but current consumption will increase.

12. KNOWN ISSUES

Issue	Explanation
Using multiple DLCs can crash iWRAP	Opening several connections to iWRAP using same channel may crash the firmware. UUID should be used instead of a channel. This is a bug in CSR firmware.
Listing remote SDP record may run out of memory	When a service discovery is made with SDP command and if *root* mode is used and remote device supports many services iWRAP may run out of memory and reset. To overcome this only a specific service should be searched for instead of using root mode.
Do not force sniff	If sniff is enabled with 'SET BT SNIFF' command iWRAP won't un sniff if remote end requests for it.
Frame mode flow control hangs	In multiplexing mode the firmware will hang if data length is longer than 100 bytes. A physical reset is needed. This is a bug in CSR firmware.
Data does not leave buffer	Sometimes if small amount of data is received, it may remain in the incoming buffer until more data is received. This is a bug in CSR firmware.
Inquiry RSSI and clock caching	If RSSI in the inquiry and clock offset caching are enabled connections can not be opened. This is a bug in CSR firmware.
HW flow control	If HW flow control is not used and iWRAP buffers are filled either in data or command mode, the firmware will hang and needs a physical reset. This is a bug in CSR firmware.
Simultaneous connection between two iWRAPs	Two simultaneous ACL connections can not be opened between two iWRAPs.
SET CONTROL INIT RESET	Issuing SET CONTROL INIT RESET will result in an infinite reset loop. PSKEY_USR_27 must be deleted to survive this condition.

Table 9: iWRAP knows issues

13. SUPPORT

- For technical questions and problems, please contact: **support@bluegiga.com**

- Firmware, parameters, tools and documentation can be downloaded from:
  http://www.bluegiga.com/techforum/

14. RELATED DOCUMENTATION

Please take a look at the following documentation also:

- **iWRAP Update Client User Guide**

- **DFU Wizard User Guide**

- **BlueFlash User Guide**

- **PSTool User Guide**

- **Performance Measurement Guide**

- **Bluetooth specification (www.bluetooth.org)**
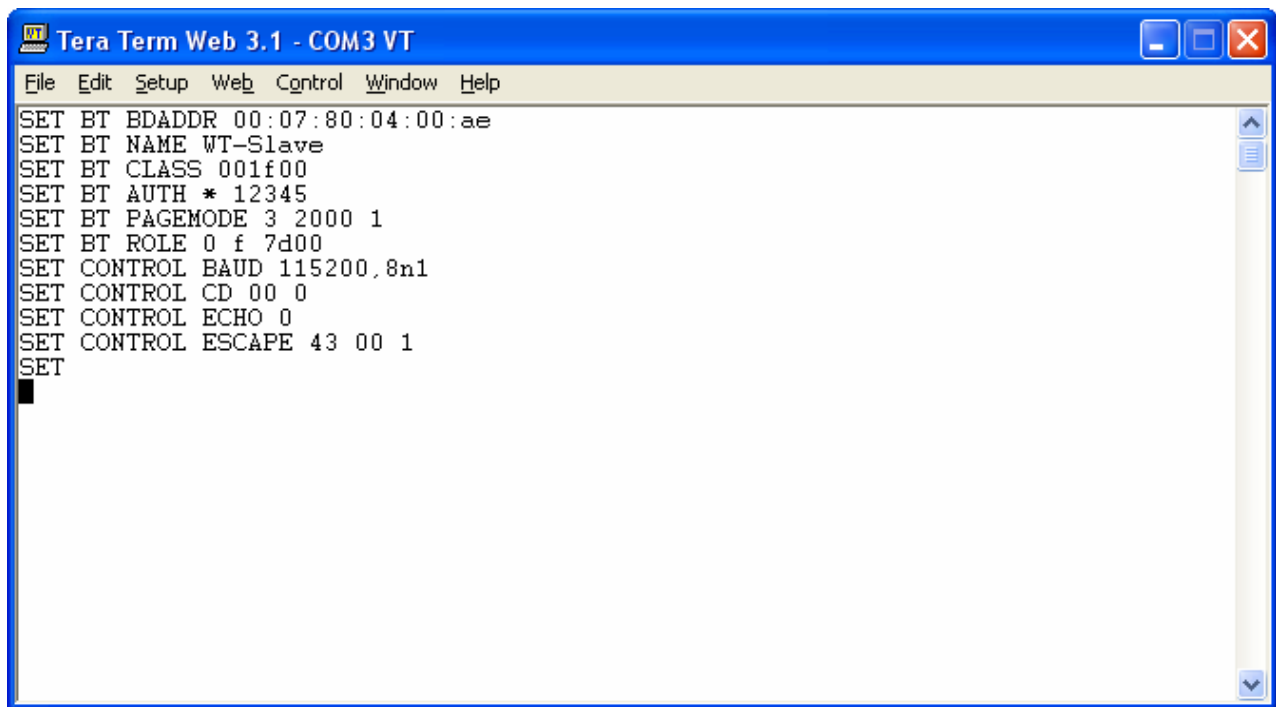
Visit also Tech-forum (**www.bluegiga.com/techforum/**) for additional information and design references.

15. IWRAP CONFIGURATION EXAMPLES

In the following chapters some iWRAP configuration and usage examples are presented.

15.1 Simple SPP slave

In this example iWRAP is configured to be a transparent SPP slave module, which only accepts connections and transmits data. No events or any other information is displayed. The configuration is displayed in the figure below:

Figure 6: Slave configuration

The important settings in the figure are the following:

- **SET BT PAGEMODE 3 2000 1**

  With this setting iWRAP is configured to be visible in the inquiry and to be connectable as a slave module should be.

  On the other hand in some cases slave mode does not need to be visible in the inquiry so our setting could be also: SET BT PAGEMODE 2 2000 1. If iWRAP is not visible in the inquiry current consumption will be 1-2mA lower.

- **SET BT ROLE 0 f 7d00**

  With this setting we have simply defined that iWRAP does not ask for master-slave switch when it's being connected. On the other hand all the link options (power saving etc.) are enabled if master wants to use them. This is the default setting.

- **SET CONTROL ECHO 0**
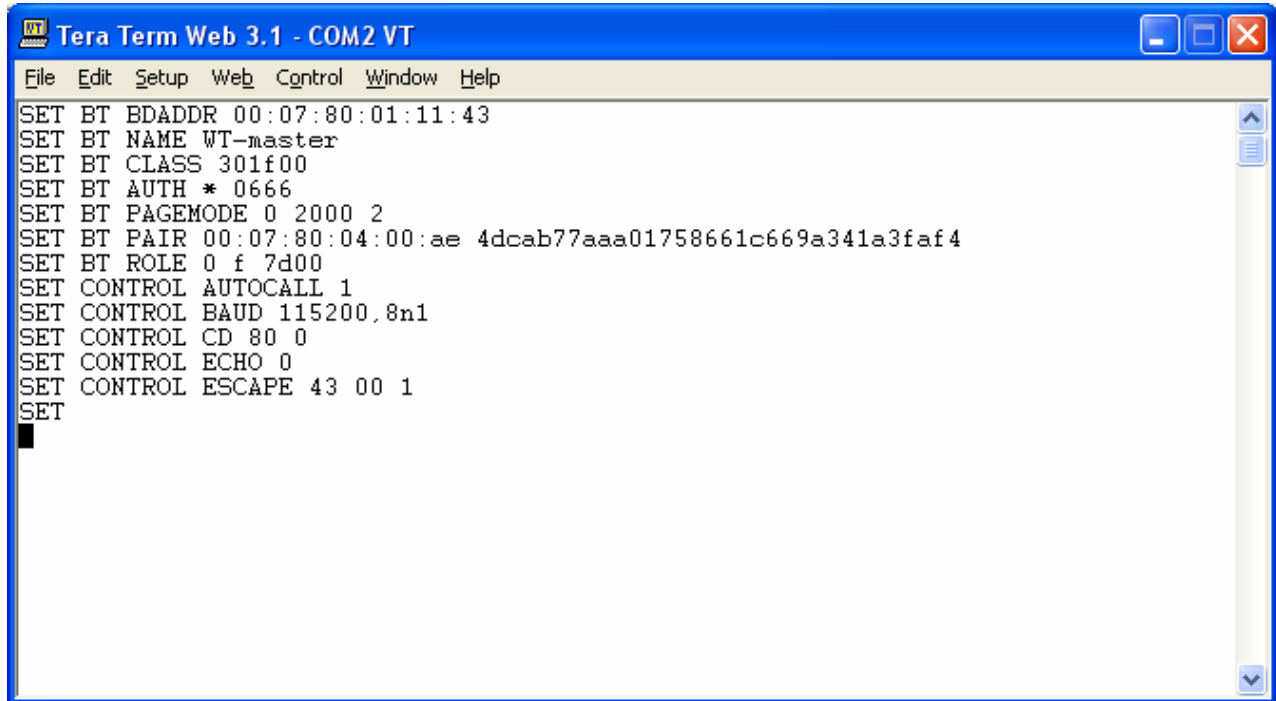
  This is important setting since we want the slave module to be transparent. That's why we disable all the event messages and boot banner by setting echo mode to 0.

Other options:

- The timeouts for the slave module can be also configured. For the slave probably the supervision timeout is important i.e. when slave notices that connection is lost. This timeout is configured with the "**SET BT ROLE**" command.

- Sometimes the data rate is important and slave does not need to know about data and command mode switches. In these cases it might be useful to disable the escape sequence to obtain a higher data rate. This is done for example by issuing command: "**SET CONTROL ESCAPE – 00 1**". With the second parameter one of the available PIO pins can be dedicated to be used as a DTR signal (to close the connection).

- To enable automatic power saving during connections "**SET BT SNIFF**" with appropriate parameters can be used.

- To minimize idle time power consumption deep sleep can be enabled by issuing "**SET CONTROL CONFIG 10**".

15.2 Simple SPP master

In this example iWRAP is configured to be a transparent SPP master module, which always tries to keep/open a connection to a defined device and keep up transparent data mode where events or any other information are not displayed. The configuration is displayed in the figure below:

Figure 7: Transparent master

The important settings in master module are the following:

- **SET BT PAGEMODE 0 2000 1**

  Master module does not need to be visible in the inquiry nor connectable, since it only opens connection(s). That is why we have chosen this pagemode. This also conserves power and speeds up connection openings.

- **SET BT PAIR 00:07:80:04:00:ae 4dcab77aaa01758661c669a341a3faf4**

Master module needs to know where is opens the connection. In iWRAP this is done based on the pairings. The slave module is the one and only paired device in master's memory. See "**SET CONTROL AUTOCALL**" for more information.

- **SET BT ROLE 0 f 7d00**

This is the default setting. Usually master module is Piconet master, but in some cases slaves want to do a master slave switch. That's why we allow it to be more flexible with any kind of devices.

Tip:

When configuring Bluetooth networks with WRAP Access server it is wise to configure the access server to act as a master device, even if it does not open the actual connections. For this kind of cases it's wise to allow the master slave switch even on a master module.

- **SET CONTROL AUTOCALL 1**

This is the key setting in a master module, since it enables the autocall feature. Parameter '1' means that master module tries to open the connection using RFCOMM channel 1. This is only a safe setting when the slave device is an other iWRAP module, since iWRAP has Serial Port Profile always on channel 1. With other devices instead of '1' you should use '1101' (UUID) if you want to open SPP connection.

Tip:

Using channel instead of UUID is faster, because when using UUID a service discovery is made and that takes around 300ms time. UUID is however safer since the channel for SPP might vary between different devices.

- **SET CONTROL ECHO 0**

This is important setting since we want the master module to be transparent. That's why we disable all the event messages and boot banner by setting echo mode to 0.

- **SET CONTROL CD 80 0**

When using a transparent master module, it's very hard to know if there is a connection or not, since no events are displayed. That's why we have enabled the carrier detect signal with command SET CONTROL CD 80 0. This means that when there is a connection IO7 is driven high. This can also be done in the slave module.

Tip:

Using IO7 for CD signal is wise especially when using LinkMatik 2 Evaluation Kits, since there is a led connected to IO7.

Options:

- The timeouts for the master module can be also configured. For the master probably the supervision timeout is important i.e. when it notices that connection is lost. This timeout is configured with the "**SET BT ROLE**" command. Also the time how long a connection establishment can take before error occurs might be important, at least for non transparent masters. This on the other hand can be configured with "**SET BT PAGEMODE**" command.

- Sometimes the data rate is important and there is possibility to use DTR signaling for controlling data and command mode switches. In these cases it might be useful to disable the escape sequence to obtain a higher data rate. This is done for example by issuing command: "**SET CONTROL ESCAPE – 80 1**". Parameter '80' defines that IO 7 is used as a DTR signal. Notice however that CD and DTR signals can not be configured to use same IO.

15.3 Bluetooth networking with iWRAP and WRAP Access Server

In this example a Bluetooth network with WRAP Access servers and iWRAP master modules is built. The network consists of several access servers and several iWRAP modules. The purpose of this network is to provide a transparent 'always on' connectivity from iWRAP modules to a PC over Bluetooth and Local Area Network. The figure below illustrates this kind of a network set up:
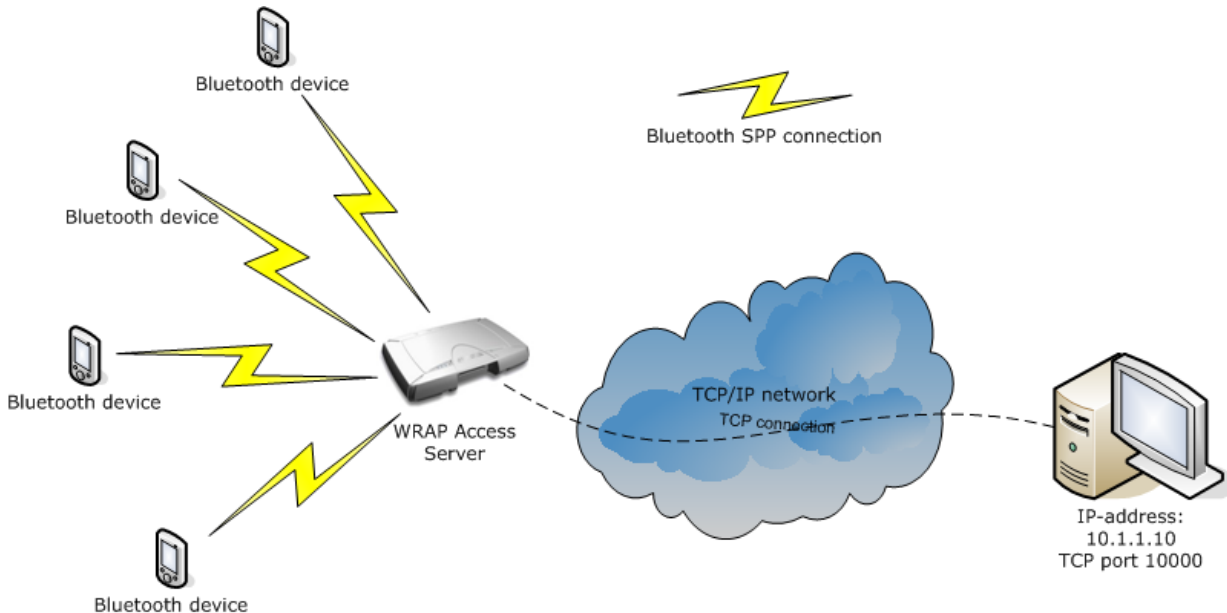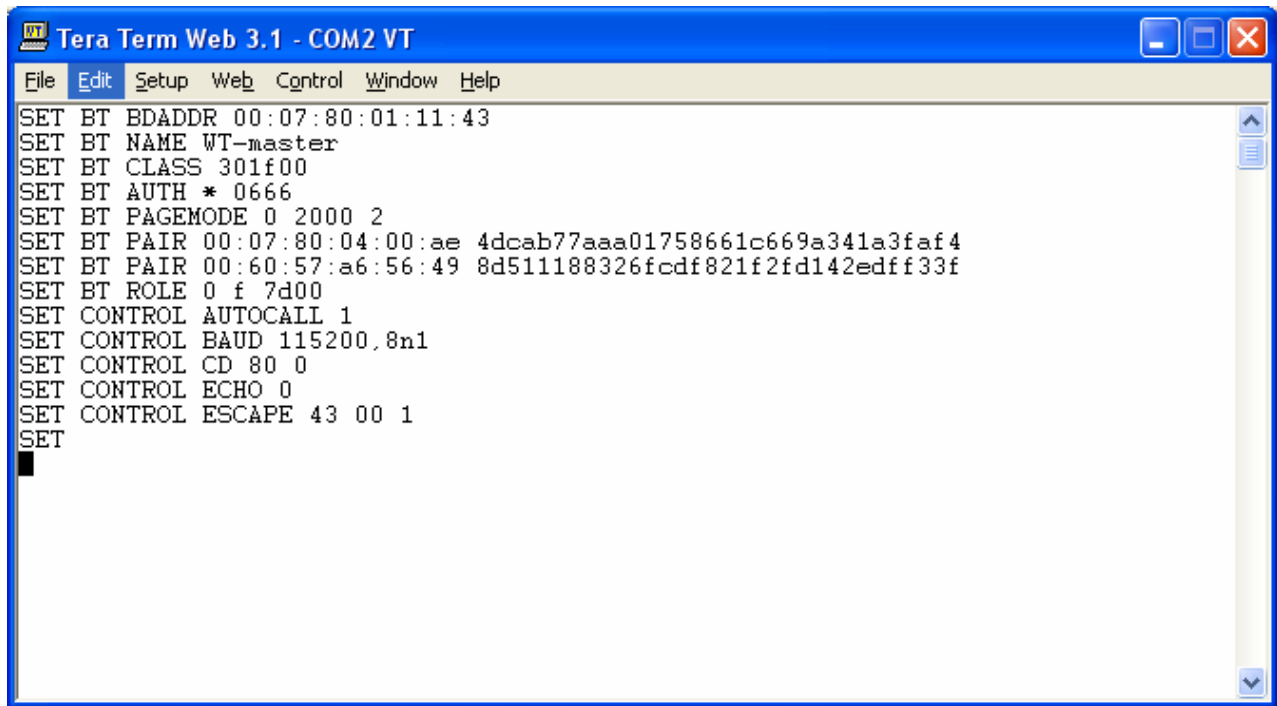
The configuration in iWRAP is totally similar than in our second example.

Also the WRAP Access Servers need to be configured correctly. The application providing the connectivity between the PC and iWRAPs is know as SPP-over-IP and it's a standard feature in WRAP Access Server with software version 2.0.4 and later.

Please refer to SPP-over-IP documentation to see how access serves are configured.

Now if there are several WRAP access servers in our network and iWRAP devices are mobile, a little bit more configuration in iWRAP modules is needed. In a mobile situation we want the iWRAP to connect to the Access Server which is in its range.

**Figure 8:** Configuration for multiple slaves

As you see the configuration is similar to configuration in the second example. The only difference is that now there are two pairings in iWRAP i.e. iWRAP is pared with two access server.

If there are several pairings in iWRAP and autocall feature is enabled, a transparent inquiry is made. When first paired device is found in the inquiry iWRAP ends the inquiry tries to connect this device. If the connection is successful iWRAP stays connected until the connection is closed or lost.

So if all the access servers in this network are paired with all the iWRAPs with this configuration a transparent 'data only, always on' network is possible to achieve. Of course there will be a short break in the connection if connection is closed or lost and iWRAP is searching and connection to a new access server.

15.4 Dial-up Networking

iWRAP has some support for Dial-Up Networking (DUN). The most common use case of DUN is connection to a mobile phone. Modern smart phones support DUN profile and it gives you access to the GSM/GRPS modem inside i.e. you can control the phone with AT-commands over a Bluetooth link (Send SMS messages, Open GSM or GPRS connections and browse phone book). The simplified example below shows how to open a DUN connection to a phone and how to send "AT" command to the phone.
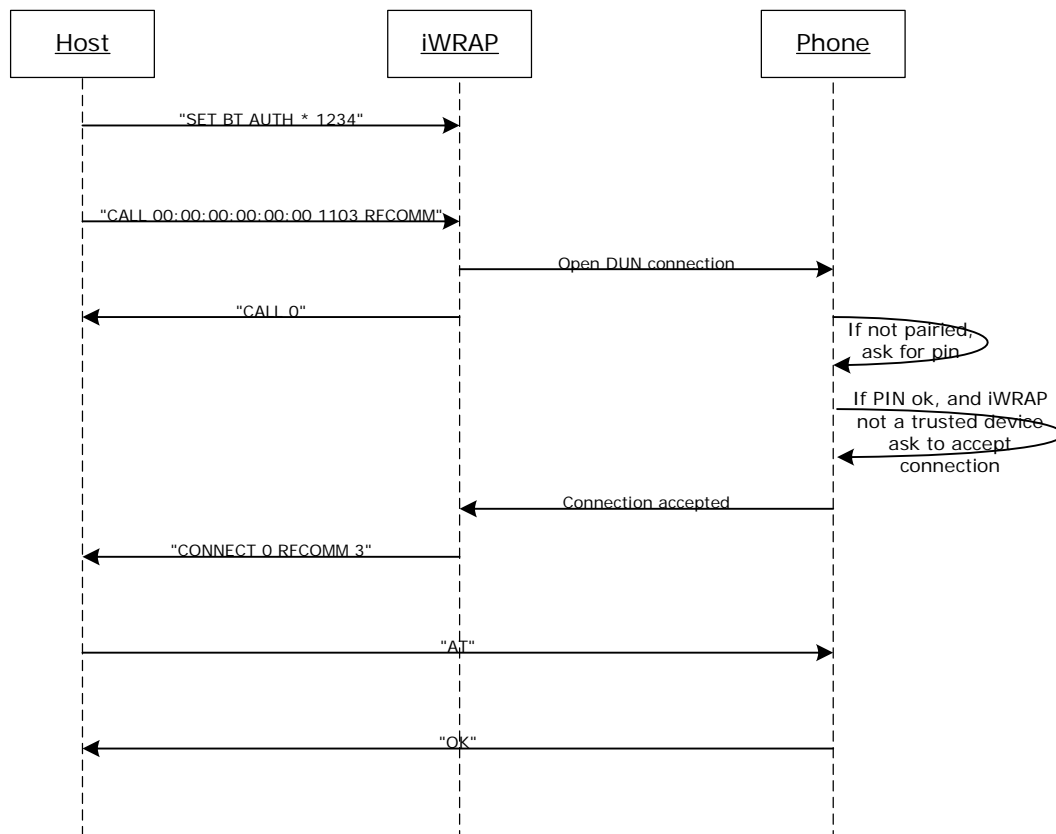
Figure 9: How to open DUN connection to a mobile phone

The pin needs to be set, since for some reason most of the mobile phones require the PIN code authentication always.

It may be wise to do the pairing from to mobile phone and make the iWRAP module 'trusted'. Once this is done the phone does not ask for the pin code every time the connection is opened.

Notice that not all the mobile phones support the same AT commands!

15.5 OBEX Object Push Profile Server

This example shows how to set up a simple Object Push Profile (OPP) server for receiving files over Bluetooth.
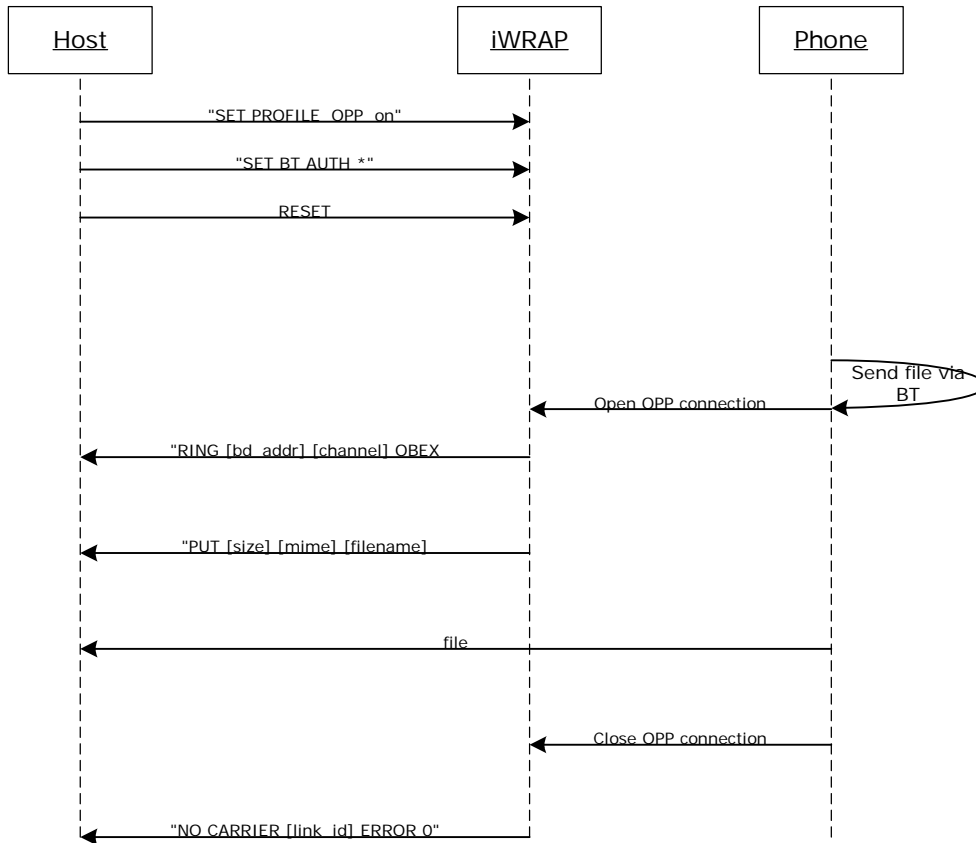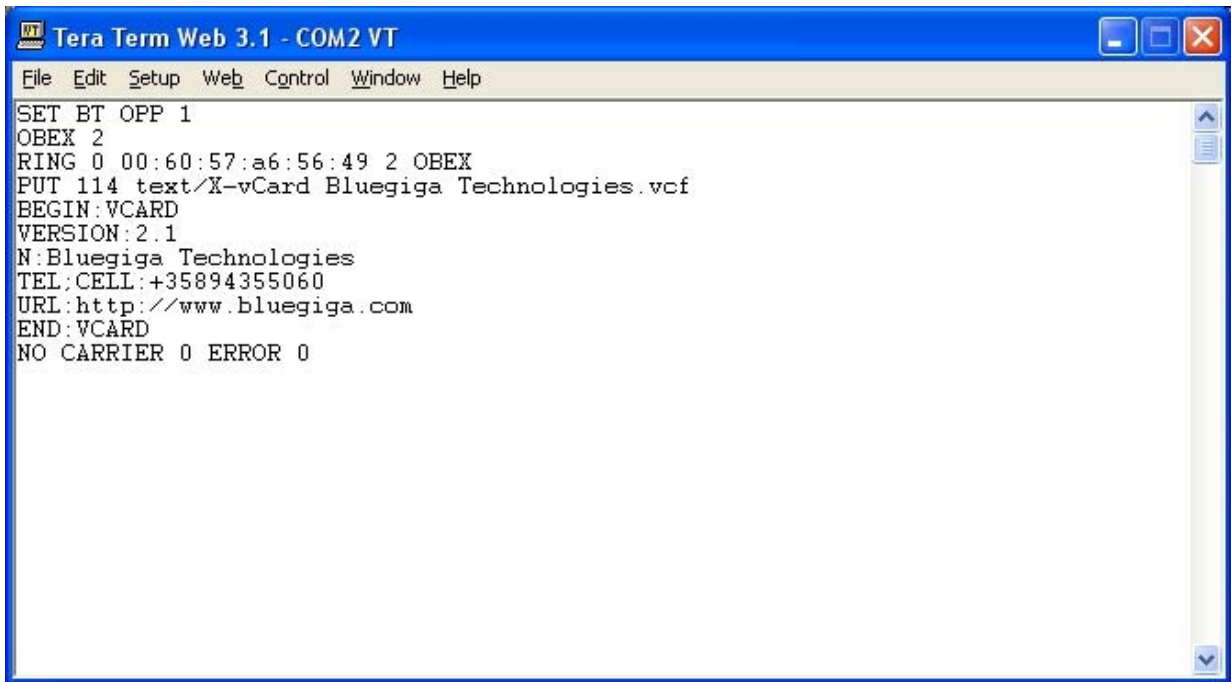

Figure 10: Receiving files via OPP

"**SET PROFILE OPP on**" enables the needed OBEX profiles in the iWRAP for receiving the files. In the example the PIN code is disabled so that the phone does not prompt for the pin when sending the file.

OPP can be disabled with "**SET PROFILE OPP**" command and issuing "**RESET**".

Some devices require that that also Class of Device (CoD) is configured correctly before they are able to send files via OBEX. A correct class of device setting can be found from Bluetooth specification.

Figure 11: Receiving a vCard over OPP

15.6 iWRAP to iWRAP Audio Connection

iWRAP supports also SCO (audio) connections. This example shows how to open a simple iWRAP audio connection.
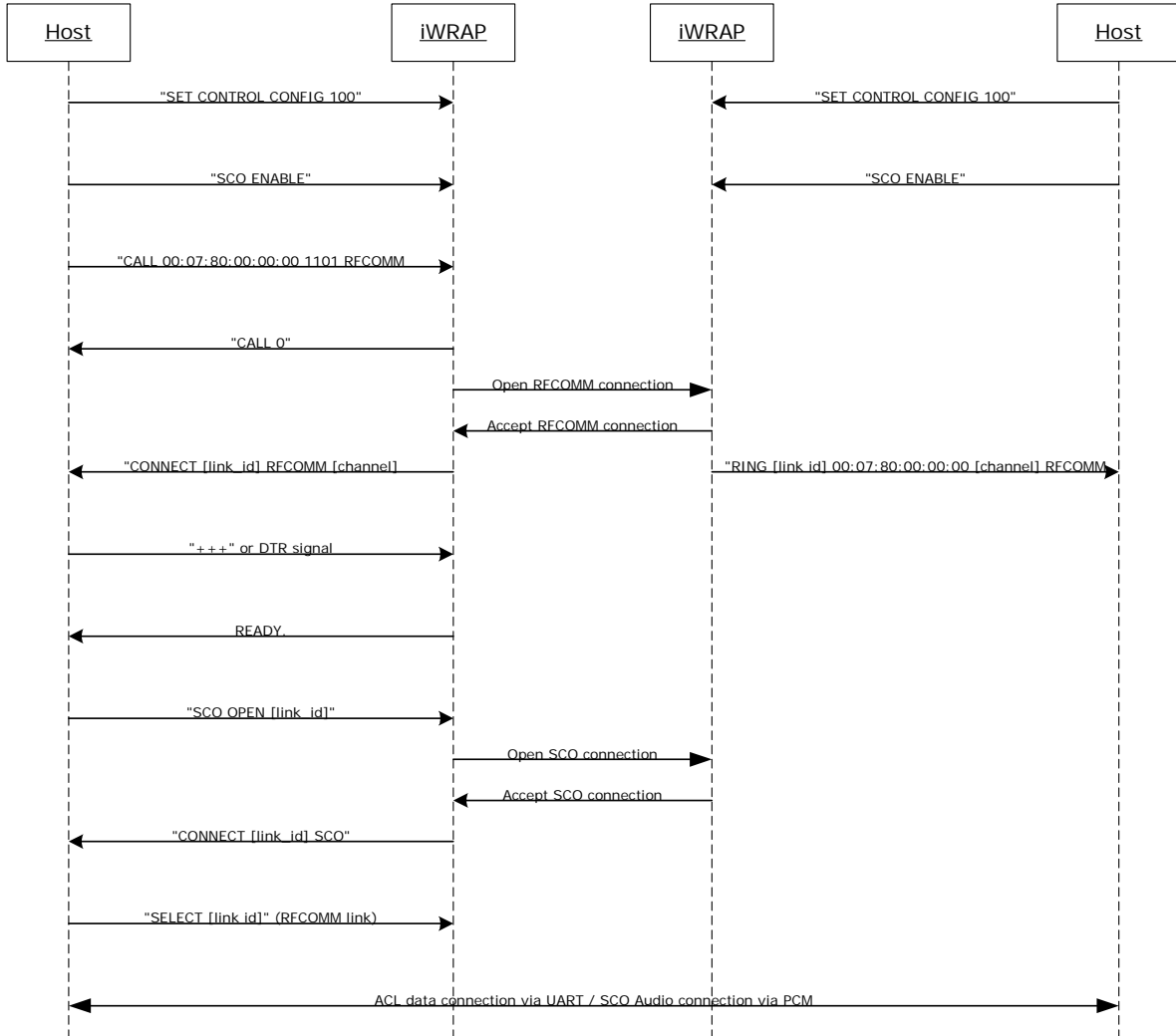

**Figure 12:** ACL data + SCO audio connection setup

"**SET CONTROL CONFIG 1000**" is fix to a CSR bug which disables master-slave switch and is needed for SCO connections. It needs to be given only once. "**SCO ENABLE**" command is needed on the other hand to indicate to iWRAP that audio connections will be used. It needs to be given every time after a reset. "**SET CONTROL INIT SCO ENABLE**" can be used to automatically enable the feature.

PS-key "**Map SCO over PCM**" needs to be set to **TRUE** for the audio to be transmitted.

Audio is routed directly to the PCM interface of the module. The existing ACL connection on the other hand can be used to send and receive data.

15.7 iWRAP to Hands-Free Audio Connection

iWRAP can also be used to transmit audio to a Bluetooth headset in a similar way as iWRAP to iWRAP audio works. The example below shows how this is done.
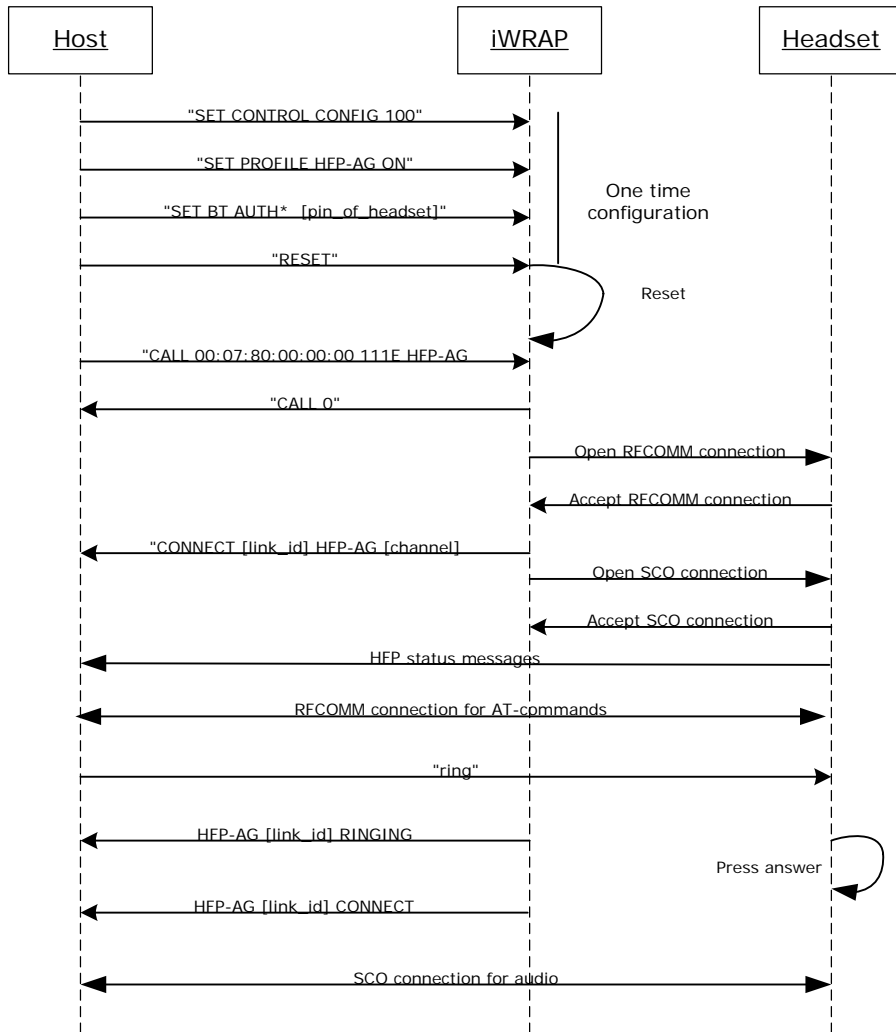
Figure 13: iWRAP to headset audio connection

Audio connection to a headset is pretty straightforward to setup. First the initializations need to be done, second the HFP-AG connection to headset-profile is opened (UUID for hands-free is 111E) and finally the SCO connection needs to be set up.

Once all this is done the RFCOMM connection can be used to transmit AT-commands to between headset and iWRAP and SCO connection on the other hand to transmit audio. Please refer to headset / hands-free profile specification for supported AT-commands.

https://www.bluetooth.org/foundry/adopters/document/HFP_1.5_SPEC_V10

15.8 iWRAP to Mobile Phone Audio Connection

iWRAP can act as a hands-free device and send audio to a mobile phone. This example below reveals how that is done.
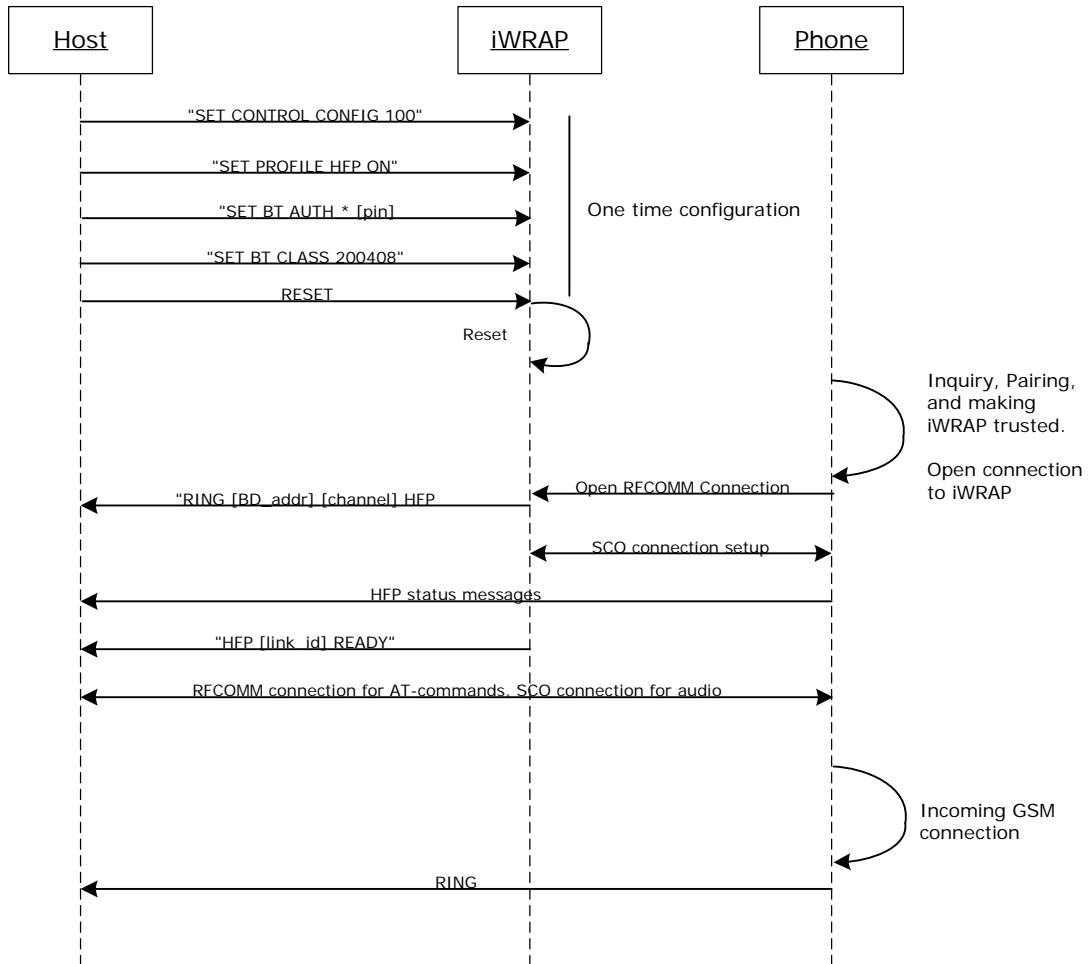
Figure 14: HFP connection to a mobile phone